Annexure-II

Discipline wise Specific Syllabus for IGNOU Ph.D. Entrance Test

1. Ph.D. Anthropology

- **Anthropology and Methods of Research**

  Introducing Anthropology: Defining Anthropology, Meaning, Scope, History, Branches of Anthropology, Emerging Frontiers in Anthropology

  Field Work Tradition in Anthropology: Field Work and its Relevance, Ethnography, Techniques, Methods and Methodology, Genealogy and Pedigree

  Research Design: Review of Literature and Statement of Research Problem, Theory, Research Design

  Data Collection Techniques: Primary Data, Secondary Data, And Biological Methods, Archaeological Methods Statistical Analysis: Collection and Presentation of Data, Measures of Central Tendency and Dispersion, Statistical Distribution, Using SPSS for Data Analysis Contents.

- **Physical Anthropology**

  Introduction to Physical Anthropology: Definition and Scope, Relationship with Other Disciplines, Applied aspects of Physical Anthropology

  Human Evolution: Principles of Evolution, Theories of Organic Evolution, Synthetic Theory,Palaeoanthropology

  Primate Study:Living Primates, Primate Behaviour.

  Biological Diversity: Concept of Race, Characteristic, Criteria of Biological Diversity, Racial Classification

  Human Genetics: Human Genetics, Methods in Human Genetics, Population Genetics, Aberrations in Chromosomes

  Human Growth and Development: Principles of Growth, Methods and Influencing Factors, Human Constitution and Physique, Reproductive Biology

  Ecological Anthropology: Fundamentals of Ecology, Adaptation to Environment, Epidemiological Anthropology.

- **Social Anthropology**

  Introduction to Social Anthropology: Social Anthropology: Nature and Scope,

Philosophical and Historical Foundations of Social Anthropology, Relationship of Social Anthropology with Allied Disciplines

Society and Culture: Concept of Society and Culture, Social Groups, Social Identity and Movements, Social Change in Indian Context

Anthropological Theories: Classical Theories, Functionalism, Structural Functionalism and Neo- Functionalism, Social Organisation and Dynamic Theories of Structure, Culture and Personality, Marxism, Structuralism, Feminism, Post-Modernism and Post-Colonialism

Kinship, Marriage and Family: Kinship, Descent and Alliance Theories, Marriage, Family, Kinship, Family and Marriage in India

Religion: Concepts and Approaches to the Study of Religion, Rituals and Symbolism, Religious Specialists *Economic and Political Organisations*: Concepts and Definitions, State and Stateless Societies: Political Institutions, Production, Consumption and Exchange, Political Power and Distribution of Resources.

- **Archaeological Anthropology**

Introduction to Archaeological Anthropology: Definitions and Scope, History and Development,Interdisciplinary Relations

Tool types and techniques in Archaeology: Space, Tool Families, Tool-Technologies, Household and Decorative Objects

Geological Framework: Time and Space, Recent Period, Human Palaeontology

Dating Methods: Relevance of Dating, Relative and Absolute dating

Lithic Cultures: Palaeolithic, Mesolithic and Neolithic. Evidence of palaeolithic culture in India *Indus Valley Civilization*.

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2. Ph.D. Political Science

- **Research Methodology**

Methodology/Framework: Systems, Marxian and Post–Modern approaches, Inter–Disciplinary approach.

Research Methods: Research Design-Research Proposal, Review of Literature, Hypothesis/Research Questions, Analysis and Interpretation of Data.

- **Political Theory & Thought**

Introduction to Political Theory: Meaning, nature and scope of political theory, Approaches– Normative, Historical and Empirical, Perspectives– Feminist and Post–

modern Concepts: Liberty, Equality and Justice, Citizenship, Civil Society Indian and Western Political Thought: Thinkers and Themes Contemporary Debates: Human Rights, Multiculturalism, Environment & Sustainable Development.

- **India: State and Society**

  Introduction: State, Society and Politics Interface (Conceptual and Theoretical Aspects) Working of the Indian Constitution

  Indian State: India's Political Economy, Nature of the Indian State, Models of Development, Development in India- Regional Variations

  Social Movements: Identity-Based Movements: Caste, Religion, Gender, Tribe, Region, Class Movements: Farmers and Working Classes

  Democracy in India: Electoral Democracy (Methodology, Issues and Debates)

- **Globalization and International Relations**

  Major theories of IR International Peace and Cooperation: National Sovereignty and Humanitarian Intervention, Human

  Security and Human Development Agenda, Environment and Sustainability

  India in the Emerging World Order: India's Neighborhood, India and Great Powers, India and the Developing World

  International Political Economy: Trade and Finance, Globalization: Mechanisms and Forums International Institutions, Regimes and Orders: International Governance-Issues and Mechanisms, Regional Economic Groupings International Civil Society and Non-State Actors in IR.

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3. Ph.D. Chemistry

PART A: - RESEARCH METHODOLOGY

1. Objectives of research
2. Research methods versus Research Methodology
3. Types of research:
   - Descriptive versus Analytical;
   - Applied versus Fundamental;
   - Quantitative versus Qualitative;
   - Conceptual versus Empirical
4. Literature Review: Methods and Importance

5. Research design: Need, Types and Features of research design
6. Formulating Research Problem
7. Collection and analysis of Data: Importance and Methods of data collection,
8. Data Analysis with Statistical Packages
9. Ethical issues in Research: Copyright, Intellectual Property Rights; Plagiarism

PART B: - I INORGANIC CHEMISTRY

1. Chemical periodicity

2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPR Theory).

3. Concepts of acids and bases: Hard-Soft acid base concept, Non-aqueous solvents.

4. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compounds.

5. Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms.

6. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.

7. Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis.

8. Cages and metal clusters.

9. Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods.

10. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transferreactions; nitrogen fixation, metal complexes in medicine.

11. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-VIS, NQR, MS,electron spectroscopy and microscopic techniques.

12. Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

II: Physical Chemistry

1. Basic principles of quantum mechanics: Postulates; operator algebra; Model systems: particle-in-a-box, harmonic oscillator; Hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling.

2. Approximate methods of quantum mechanics: Variation principle; perturbation theory up to second order in energy; applications.

3. Atomic structure and spectroscopy: term symbols; many-electron systems and

antisymmetry principle.

4. Chemical bonding: Elementary aspects of MO and VB theories; Huckel theory for conjugated π-electron systems.

5. Chemical applications of group theory: symmetry elements; point groups; character tables; selection rules.

6. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.

7. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.

8. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems.

9. Electrochemistry: Nernst equation, redox systems, electrochemical cells; DebyeHuckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.

10. Chemical kinetics: Empirical rate laws and temperature dependence; complex ; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.

11. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.

12. Solid state: Crystal structures; Bragg's law and applications; band structure of solids.

13. Polymer chemistry: Molar masses; kinetics of polymerization.

14. Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance and correlation coefficient.

III. Organic Chemistry

1. IUPAC nomenclature of organic molecules including regio- and stereoisomers.

2. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction.

3. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions.

4. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes.

5. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.

6. Common named reactions and rearrangements – applications in organic synthesis.

7. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regioand stereoselective transformations.

8. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.

9. Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction – substrate, reagent and catalyst controlled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution – optical and kinetic.

10. Pericyclic reactions: electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.

11. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).

12. Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids.

13. Structure determination of organic compounds by IR, UV-Vis, 1H &13C NMR and Mass spectroscopic techniques.

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4. Ph.D. Geology

Structure:

Section	Name of the Section	S. No.	Course Title
A.	RESEARCH METHODOLOGY	1	Research Methodology in Geology
B.	DISCIPLINE SPECIFIC COURSES	2	Physical Geology and Geomorphology
		3	Structural Geology and Tectonics
		4	Stratigraphy and Palaeontology
		5	Mineralogy
		6	Petrology
		7	Georesources and Economic Geology
		8	Geochemistry
		9	Applied Geology

SECTION A. RESEARCH METHODOLOGY

1. Research Methodology in Geology:

Definition, outcome and importance of geological research; theory and philosophy of research methodology in context to geology; emerging areas and interdisciplinary research in Geology.

Identifying and defining research problem; techniques involved in defining research problem and identifying gaps; sources of literature; implications of literature collection and its review.

Preparation and planning for fieldwork; field kit and equipments; safety measures in field; field procedures and precautions taken during sampling; maintenance of field notebook; uses of topographical maps and satellite images; selection of traverses; recognition of geological features, rock types and stratigraphic contacts in field; use of clinometer compass, measurement of dip and strike of strata; measurements of geologic sections; uses of GPS; recording field observations in field notebook; geological mapping.

Data collection; sampling methods; data collection methods in sedimentology, palaeontology, stratigraphy, structural geology and tectonics, mineralogy, petrology, ore geology and hydrogeology; classification and presentation of data; role of statistics and computers in research; use of computer in data processing; methods of communicating and displaying analysed data; applications of Geographic Information System.

Thin section preparation; petrological and palaeontological microscopes; Ore microscopy; SEM microphotography; preparation of samples for geochemical and XRD analysis, heavy mineral separation; construction of lithologs; geophysical exploration methods, remote sensing data.

Intellectual property rights, patents, copyright and related rights; ethics-plagiarism and integrity.

SECTION B. GEOLOGY COURSES

2. Physical Geology and Geomorphology:

Composition of the crust and Earth as a whole; basic concepts and significance of geomorphology; relationship between landforms and geomorphic processes- fluvial, aeolian, glacial, and marine; soils; geomorphology of India; applications of geomorphology; mountainbuilding; volcanoes and earthquake; seismic belts of India.

3. Structural Geology and Tectonics:

Classification of folds and faults; Mechanism of folding; concept of stress and strain and their geological significance; joints and unconformities. concept of plate tectonics; palaeo magnetism, polar wandering and reversal of Earth's magnetic field; sea-floor spreading, island arcs and mountain chains.

4. Stratigraphy and Palaeontology:

Principles of stratigraphy, time scale and its divisions; stratigraphic classifications; stratigraphic nomenclature; stratigraphic correlation; facies concept in stratigraphy; marine transgression and regression; ice ages; broad stratigraphic subdivisions of India.

Fossil and modes of fossilization; application of fossils in age determination; evolutionary trends and geologic distribution of Brachiopoda, Pelecypoda, Gastropoda, Cephalopoda, Trilobita, Echinoids, Graptolites and Corals; elementary idea about the origin of major groups of vertebrates; evolutionary history of Horse, Elephant and Man; plant life through geologic ages.

5. Mineralogy:

Physical and optical properties of minerals; classification of minerals; mineralogy of silicates, polymorphism, isomorphism and pseudomorphism; solid solution and exsolution; X-ray crystallography; concept of symmetry; crystallographic classification.

6. Petrology:

Generation and evolution of magma; Bowen's reaction series; textures and classification of igneous rocks; phase equilibria: single, binary and ternary systems; silicate systems; genesis and tectonic setting of different magma types; cooling and crystallisation of magma.

Sedimentation, lithification and diagenesis; structures and textures; classification of sedimentary rocks; depositional environments; sedimentation and tectonics; heavy minerals and their applications in provenance studies.

Metamorphism and metamorphic processes; metamorphic differentiation; metamorphic facies; types of metamorphism and metamorphic rocks; metasomatism and anatexis.

7. Georesources and Economic Geology:

Ore genesis; ore localisation and ore shoots; ore dressing and beneficiation; strategic, critical and essential minerals; national mineral policy; economic minerals of India; fossil fuels.

8. Geochemistry:

Cosmic abundances of elements; geochemical classification and differentiation of the elements; trace element geochemistry; radiogenic and non-radiogenic isotopes; concept of geochemical and biogeochemical cycles and global climates.

9. Applied Geology:

Engineering Geology: Engineering properties of rocks; geological investigations, seismic parameters and remedial measures related to the construction of dams, bridges, highways and tunnels; mass movements with special emphasis on landslides and causes of hill slope instability.

Mineral Exploration: Principles and methodology of geological prospecting for economic minerals and rocks; sampling methods, methods for estimating reserve and resources, grade and tonnage calculation of the deposits; pathfinder elements; geochemical and geophysical methods; mining in India.

Hydrogeology: Hydrological cycle; hydrological properties of rock; distribution of surface and groundwater in the Earth's crust; global water budget; movement of groundwater; aquifers classification and characteristics; Darcy's law; Theis equation; water table; flow nets; groundwater provinces of India; groundwater quality and pollution; groundwater prospecting; desalination; springs and its types.

Environmental Geology: Environment and energy; non-conventional energy resources; geoenvironment; environmental hazards, instrumentation and analysis; disposal of municipal, domestic, hospital, solid and nuclear wastes; oil spills; environmental impact assessment (EIA); environmental legislation: national/international standards; application of remote sensing and GIS in environmental management.

Remote Sensing and GIS: Electromagnetic radiation; aerial photographs and their geometry; elements of photo and image interpretation; satellite remote sensing; global and Indian space missions, sensor and their characteristics; digital image processing techniques; geological applications of remote sensing, GIS and GPS.

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5. Ph.D. Life Sciences

PART-I (RESEARCH METHODOLOGY)

1. Research Methodology: An Introduction:

Meaning of Research; Objectives of Research; Motivation in Research; Types of Research; Research Approaches; Significance of Research; Research Methods versus Methodology; Research and Scientific Method; Importance of Knowing How Research is Done; Research Process; Criteria of Good Research; Problems Encountered by Researchers in India.

2. Defining the Research Problem:

What is Research Problem?; Selecting the Problem; Necessity of Defining the Problem; Technique Involved in Defining a Problem; An Illustration.

3. Research Design:

Meaning of Research Design; Need for Research Design; Features of a Good Design; Important Concepts Relating to Research Design; Different Research Designs; Basic Principles of Experimental Designs Conclusion.

4. Issues in The Design and Conduct of Selected Research Designs:

Descriptive Research – Descriptive Research: Main Steps, Correlation Studies: Basic Issues, Case Study Method; Observational Studies – Issues in the Design of Case-Control Studies, Issues in the Design of Cohort Studies; Experimental Research – Three Characteristics of Experimental Research, Steps Involved in Experimental Research, Design of Experimental Study.

5. Sampling Design:

Census and Sample Survey; Implications of a Sample Design; Steps in Sampling Design; Criteria of Selecting a Sampling Procedure; Characteristics of a Good Sample Design; Different Types of Sample Designs; How to Select a Random Sample; Random Sample from an Infinite Universe; Complex Random Sampling Designs.

6. Measurement and Scaling Techniques:

Measurement in Research; Measurement Scales; Sources of Error in Measurement; Tests of Sound Measurement; Technique of Developing Measurement Tools; Scaling; Meaning of Scaling; Scale Classifications Bases; Important Scaling Techniques; Scale Construction Techniques.

7. Methods of Data Collection:

Collection of Primary Data; Observation Methods; Interview Method; Collection of Data through Questionnaires; Collection of Data through Schedules; Difference between Questionnaires and Schedules; Some Other Methods of Data Collection; Collection of Secondary Data; Selection of Appropriate Method of Data Collection; Case Study Method.

8. Processing and Analysis of Data:

Processing Operations; Some Problems in Processing; Elements/Types of Analysis; Statistics in Research; Measures of Central Tendency; Measures of Dispersion; Measures of Asymmetry (Skewness); Measures of Relationship; Simple Regression Analysis; Multiple Correlation and Regression; Partial Correlation; Association in Case of Attributes; Other Measures.

9. Sampling Fundamentals:

Need of Sampling; Some Fundamental Definitions; Important Sampling Distributions; Central Limit Theorem; Sampling Theory; Sandler's *A*-test; Concept of Standard Error; Estimation; Estimating the Population Mean (μ); Estimating Population Proportion; Sample Size and its Determination; Determination of Sample Size through the Approach; Based on Precision Rate and Confidence Level; Determination of Sample Size through the Approach; Based on Bayesian Statistics.

10. Testing of Hypotheses-I (Parametric or Standard Tests of Hypotheses):

What is a Hypothesis?; Basic Concepts Concerning Testing of Hypotheses; Procedure for Hypothesis Testing; Flow Diagram for Hypothesis Testing; Measuring the Power of a Hypothesis Test; Tests of Hypotheses; Important Parametric Tests; Hypothesis Testing

of Means; Hypothesis Testing for Differences between Means; Hypothesis Testing for Comparing Two Related Samples; Hypothesis Testing of Proportions; Hypothesis Testing for Difference between Proportions; Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance; Testing the Equality of Variances of Two Normal Populations; Hypothesis Testing of Correlation Coefficients; Limitations of the Tests of Hypotheses.

11. Chi-square Test:

Chi-square as a Test for Comparing Variance; Chi-square as a Non-parametric Test; Conditions for the Application of X^2 Test; Steps Involved in Applying Chi-square Test; Alternative Formula; Yates' Correction; Conversion of X^2 into Phi Coefficient; Conversion of X^2 into Coefficient by Contingency; Important Characteristics of X^2 Test; Caution in Using X^2 Test.

12. Analysis of Variance and Covariance:

Analysis of Variance (ANOVE) What is ANOVA?; The Basic Principle of ANOVA; ANOVA Technique; Setting up Analysis of Variance Table; Short-cut Method for One-way ANOVA; Coding Method; Two-way ANOVA; ANOVA in Latin-Square Design; Analysis of Co-variance (ANOCOVA); ANOCOVA Technique; Assumptions in ANOCOVA.

13. Testing of Hypotheses-II (Nonparametric or Distribution-free Tests):

Important Nonparametric or Distribution-free Test; Relationship between Spearman's *r*'s and Kendall's *W*; Characteristics of Distribution-free or Non-parametric Tests.

14. Multivariate Analysis Techniques:

Growth of Multivariate Techniques; Characteristics and Applications; Classification of Multivariate Techniques; Variables in Multivariate Analysis; Important Multivariate Techniques; Important Methods of Factor Analysis; Rotation in Factor Analysis; *R*-type and *Q*-type Factor Analyses; Path Analysis.

15. Interpretation and Report Writing:

Meaning of Interpretation; Why Interpretation?; Technique of Interpretation: Precaution in Interpretation; Significance of Report Writing; Different Steps in Writing Report; Layout of the Research Report; Types of Reports; Oral Presentation; Mechanics of Writing a Research Report; Precautions for Writing Research Reports.

16. The Computer: It's Role in Research:

Introduction; The Computer and Technology; The Computer System; Important Characteristics; The Binary Number System; Computer Applications; Computers and Researcher.

References

1. Research Methodology: Methods and Techniques – C.R. Kothari.
2. Research Methodology: Methods and Statistical techniques – Santosh Gupta.
3. Statistical Research Methods in the Life Sciences by P.V. Rao.
4. Research Methods – A tool for life by Bernared C. Beins.

PART-II (LIFE SCIENCES)

1. Cell & Molecular Biology

Cell as a unit of life? Schleiden and Schwann cell theory re-examined. Cell separation, sub- cellular fractionation. Properties of intact cells: regulation of cell shape, limitation of cell size, cellular movements, cell adhesion, cell junctions and the extracellular matrix, cell –cell adhesion and communication; cell matrix adhesion, collagen the fibrous protein of the matrix, noncollagen component of the extracellular matrix;, the cytoskeleton, the nature of cytoskeleton, intermediate filaments, microtubules, microfilaments, actin filaments, cilia and centrioles, organization of the cytoskeleton, tissue organisation.

Biological membranes, integral membrane proteins, lipoproteins, phospholipids and trafficking through membrane. Membrane structure, energetic and biosynthesis. Cell growth and division, overview of the cell cycle and its control, the molecular mechanisms for regulating mitotic events, cell cycle control in mammalian cells, checkpoints in cell cycle regulation. The Cell nucleus: Nuclear envelop, Nuclear pore complex, Nucleocytoplasmic transport, Nucleolus, chromosomes, karyotypes, Heterochromatin and euchromatin, lampbrush chromosomes and Polytene chromosomes.

Conformation of nucleic acid- DNA (A, B, Z-DNA), RNA (mRNA, tRNA, rRNA) and micro RNA. DNA replication- General features, DNA Polymerases in prokaryotes and eukaryotes, DNA replication in prokaryotes and eukaryotes. Genetic code: Properties, Wobble hypothesis. Protein Synthesis a) Transcription in prokaryotes and eukaryotes, RNA processing b) Translation: Initiation, elongation and termination of polypeptides, Modification and folding of released polypeptide, Protein translocation across membrane.

Organelles of eukaryotic cells: the lysosomes, peroxisomes, the Golgi apparatus, endoplasmic reticulum. Mitochondria and chloroplast, Structure of the mitochondria and chloroplast, oxidation of glucose and fatty acids, electron transport and oxidative phosphorylation. chloroplast and photosynthesis. Organelle biosynthesis, protein sorting: organelle biogenesis and protein secretion, synthesis and targeting, of mitochondrial chloroplast, peroxisomal proteins and translational modification in the ER. Intracellular traffic, vesicular traffic in the secretary pathway, protein sorting in the Golgi, traffic in the endocytic pathway, exocytosis.

Suggested Reading:

1. Molecular Biology of the Cell-Alberts *et al* (5th edn. 2007 or later Recent Edition)
2. The Cell: A molecular approach-Cooper and Hausman
3. Molecular Cell Biology Lodish *et. al*. (6th edn, 2008 or later Recent Edition)
4. Genes IX. Lewin (2008 or later Recent Edition),
5. Molecular Biology of the Gene. Watson *et. al*. (6th edn. 2009)
6. Cell Biology (Cell & Molecular Biology)- F Sheeler, 6th Edition John Wiley & Sons.

2. Genetics & Molecular Evolution

What is gene?: Introduction and recapitulation: scope of genetics; DNA as genetic material; basic structure of DNA and RNA; DNA replication: Messelson and Stahl Experiment, Carins Experiment, Okazaki experiment, basic mechanism of DNA replication; cell division and cell cycle: mitosis, meiosis, chromosomal basis of inheritance; basic principles of Mendelian Inheritance: segregation and independent-assortment, alleles and multiple alleles, human pedigrees and inheritance. Gene Interaction: Sex determination and sex-linked inheritance, sex-determination in humans, *Drosophila* and other animals, sex-determination in plants, sex-linked genes and dosage compensation of X-linked genes, human genetics: pedigree analysis.

Linkage analysis and gene mapping in eukaryotes, coupling and repulsion phases; crossing- over and recombination. Benzer's experiment: Fine Structure of gene and gene concept. Chloroplast and Mitochondrial inheritance: yeast, *Chlamydomonas/ Neurospora* and higher plants.

Microbial Genetics: modes of genetic exchange in microbes, transformation, transduction, conjugation, evolutionary significance. Mutations, spontaneous and induced mutations, chromosomal mutation and aberrations, change in chromosome number: trisomy and polyploidy. Evolutionary history of bread wheat, aneuploids – Nullisomics and monosomics, somatic aneuploids, changes in chromosome structure, properties of chromosomes for detection of structural changes, Main type of changes– transitions, transversions and substitutions, deletions, duplications and inversions. Mechanism of chromosome mutations, genetic and cytological features of deletions, duplications, inversions, translocations, somatic vs germinal mutation.

Population genetics: application of Mendel's laws to whole population, calculation of allele frequencies, Hardy -Weinberg principle for calculating recessive gene frequency, calculating frequency of sex –linked alleles.

Genes and genome organization, Transposons and retrotransposons, Epigenetics. Principles & applications of genetic engineering; tools and techniques; cloning vectors & expression vectors; Biosafety.

Introduction to molecular evolution: a brief history of the pre DNA era, gene structure, genetic code and mutation. Dynamics of genes in population, random genetic drift, genetic polymorphism, Neo Darwinian theory, evolution of finite and structured population, evolution of dip bit populations. Evolutionary change in nucleotide re-genesis, nucleotide substitution, divergence between DNA sequences. Molecular phylogenetics, methods and examples, molecular clocks, concerted evolution of

multigene families, DNA polymorphism. Factors influencing molecular evolution, Role of mutation and selection in molecular evolution.

Genome organization and evolution, evolution of prokaryotic and eukaryotic genomes, C value paradox, tandem repetitive sequences, Cell Theory, Evolution & selection, Lamarkism, Darwin's contributions .Pattern of Evolution. Process of evolution: natural & artificial. Constraints & tradeoffs. Genetic drift and role of chance. Gene flow. Gene flow versus drift. Natural selection versus sexual selection. Speciation, allopatry, sympatry, peripatry and parapatry.

Suggested reading:

Genetics

1. Introduction to Genetic Analysis, by Griffiths *et al,* (9th edition.2008 or later edition)
2. Concepts of Genetics, by Klug *et al* (9 th Edition, 2009, or later edition)
3. Principles of Genetics by Snustad *et a*l (2004 Ed. or later edition)

Evolution

1. Evolutionary Genetics, John Maynard Smith, Oxford University Press, New York, 1998.
2. Genes and Evolution, A.P. Jha, Mc Graw Hill Publishers, New Delhi, 1993.
3. Molecular Cell Biology 5th Edition, Lodish *et al*., 2004, W.H. Freeman and Company,New York.
4. The World of the Cell Becker, Klein smith and Hardin, 5th Edition, 2004, PearsonEducation Pvt. Ltd.

3. Ecology

Introduction to ecology. Interaction between environment and biota, Evolutionary ecology and molecular ecology, environmental concepts – laws and limiting factors, ecological models. Ecological concept of species: Autecological level (genecology), Synecological level (Ecosystem level). Ecads (Ecophenes), Ecotypes, Ecospecies. Concepts of Ecosystems: Types – Fresh water, marine and terrestrial – Nature and components of ecosystem – Application of laws of thermodynamics, productivity, food chain, food webs, trophic levels, energy flow through ecosystem, resilience of ecosystem, ecosystem management. The biosphere, biomes, ecological pyramids and recycling.

Plant community: Concept. Methods of study of communities–Floristic, Physiogenomic and Phytosociological methods. Classification – Raunkiaer's and Clements systems, individualistic concept of Gleason, Vegetation continuum concept of Whittaker and Curtis, Ecotone, Ecological succession on land and water. Characteristics of population, population size and exponential growth, population dynamics, life history pattern, fertility rate and age structure. Competition and coexistence, intra-specific and

inter-specific interactions, scramble and contest competition model, mutualism and commensalisms, prey-predator interactions.

Phytogeography**;** Definition of static and dynamic phytogeography**,** Geological history and evolution of plant and animal life**,** Factors of distribution of plants and animals. Theories concerning present and past distribution – continental drift, glaciations, existence of land bridges and their effect on distribution of species, Phytogeographic regions of world (Vegetational belts)**,** Soil, climate, flora and vegetation of India.

Ecological adaptations in plants and animals: Deserts (Dry and Cold,), Tundra, Grassland, Savannah, temperate forest, tropical rain forest, mangroves, Fresh water, marine and estuaries. Environmental Stresses and their management, global climatic pattern, coping with climatic variations.

Environmental Laws and International Conventions: Environmental Impact Assessment, Forest (Conservation) Act and Wildlife (Protection) Act and their amendments, Environment (Protection) Act, Biodiversity Act, Convention on Biological Diversity and Kyoto Protocol, Montreal Protocol and Cartagena Protocol, Ramsar Convention on Wetlands. CITIES, India's Protected Area Network, Project Tiger and Ganga Action Plan, National Environmental Policy, Biodiversity Action Plant, Concept of Ecotourism and Ecocities**.**

Pollution: Major classes of contaminants; causes, effects and preventive measures of air, water, soil and radiation pollution; atmospheric ozone, ozone layer depletion; biotransformation, detoxification, elimination and accumulation of toxicants. Biomagnification. Pesticides and other chemicals in agriculture and industry. Impact of pollutants on biodiversity of microbes, animals and plants. Bioindicator and biomarkers of environmental health. Biodegradation and bioremediation of chemicals, biosafety and climate change.

Suggested Literature:

1. Fundamental Processes in Ecology: An Earth system Approach, Wilkinson, D.M., (2007 or latest edition), Oxford University Press, UK.

2. Addision, M.J.. Ecology: An Evolutionary Approach, Wesley Publishing Co. New Delhi. (1984 or latest edition) Arora,. Fundamentals of Environmental Biology. (1995 or latest edition) Kalyani Publishers, New Delhi.

3. Chapman.. Ecology – Principles and Applications. (1999 or latest edition) Cambridge University Press. Foundation Books, New Delhi

4. Jeffrey. D.W. 1987. Soil Plant relationship – An Ecological Approach. Croom Helm.

5. Krishnamurti, C. R. and Viswanathan, P. (Eds.). Toxic metals in the Indian Environment. (1991 or latest edition). Tata McGraw Hill Publishing Co. Ltd. New Delhi.

6. Mackenzie, A. Ball, A.S. and Virdee S.R. Instant notes in Ecology. (1999 or latest edition).Viva Books Pvt.Ltd., New Delhi.

7. Trivedi, P.R. and Gurudeep Raj. Environmental Biology. (1995 or latest edition). Akashdeep Publishing House, New Delhi.

4. Microbiology

History and Development of Microbiology. Microbial evolution, systematics and taxonomy-evolution of earth and earliest life forms; primitive organisms, their metabolic strategies and molecular coding. Changing concepts in microbiology taxonomy, Bergey's manuals, earlier systems, molecular taxonomy and ribo typing of microorganisms, Jackard's similarities coefficients. Historical development of microbiology, general techniques in microbiology. The microbial cell: general organization of cell, prokaryotes, eukaryotes and Archaea, cell wall organization of prokaryotes, eukaryotes and Archaea, cell surface appendages-pilli, locomotion by flagella chemotactic movement, peptidoglycan synthesis - inhibitors in different steps. Bacterial plasmid and its significance.

Viruses –structure, chemical composition and replication, classification, interferons. General account of Mycoplasma. Growth, recombination, growth kinetics and regulation, effect of environmental factors on growth e.g., pH. temperature, oxygen, nutrient limitations and nutrition: batch and continuous cultures, nutritional classification of microorganisms, nutritional uptake by microorganisms (C.N.P).

Metabolic Pathways: metabolic versatility of microbes, anaerobic carbon metabolism: anaerobic respiration, sulphate respiration, reference to glycolysis, fermentation – diverse fermentation products, putrefaction, methane oxidizing and methanogenic bacteria, aerobic carbon metabolism: TCA cycle, alternative metabolic pathways. Energy Metabolism: chemo autotrophs, hydrogen bacteria, phototrophic bacteria/cyanobacteria.

Advanced Bacterial Metabolism: recent advances in unusual bacterial metabolism pathways. Microbes in extreme environment: The basis of extremophiles and their applications, thermophile and halophiles. Quorum sensing in Bacteria: gram negative bacteria: LUXI LUXR-Type: gram positive bacteria: peptide mediated quorum sensing. Microbial Diseases-disease reservoirs; epidemological terminologies; infectious disease transmission; respiratory infections caused by bacteria and viruses; tuberculosis; Sexually transmitted diseases including; disease transmitted by animals (rabies), insects and ticks (rickettsias, malaria) food and water borne diseases; public health and water quality; pathogenic fungi; Emerging and resurgent infectious diseases.

Host Parasite Relationships-Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host; colonization and factors predisposing to infections; types of toxins (exotoxin, endotoxin and entreotoxin) and their structure; mode of actions. Biochemical, physiological. Genetic aspects of symbionts, Physiology and Molecular Biology of symbiosis; nonspecific and specific defense mechanisms.

Mechanism of pathogenesis, host factors influencing resistance to infection. Vaccination

Chemotherapy and Antimicrobial agents; Sulfa drugs; Antibiotics; Pencillins and Cephalosporins; Broad-Spectrum antibiotics; Antibiotics from prokaryotes; Antifungal antibiotics; Mode of action; Resistance to antibiotics. Application of Microbiology in industrial, agriculture and waste water management: symbiotic nitrogen fixation, *Rhizobium, Azotobacter, Cyanobacteria (Anabaena, Azolla etc.), Mycorrhiza* and VAM fungi, Siderophores and other PGRs. Major industrial products from microbes, beverages, antibiotics, secondary metabolites and recombinant products. Biodegradation by microbes, sewage pollution control, control of oil spills, superbugs**.**

Suggested reading:

1. Microbiology, J.G. Cappuccino, N. Sherman, Pearson Education Publications.
2. Essential Microbiology, Stuart Hogg, John Wiley and Sons Limited.
3. Microbiology: A Human Perspective, E.W. Nester, D.G. Anderson, C.E. Roberts, N.N. Pearsall, M. T. NesterMc Graw Hill Higher Education.
4. Manual of Environmental Microbiology, C. J. Hurst, R.L.Crawford, G.R.Knudsen, M.J. McInerney, L.D.Stetzenbach,, ASM Press.
5. Microbiology, L.M. Prescott, J. P. Harley, D.A., Klein, Mc Graw Hill International Edition.
6. General Microbiology. H.G. Schlegel, Cambridge University Press.
7. Dube RC and Maheshwari, D.K. – S. Chandpal.

5. Immunology

Introduction to Immune system – Innate and Acquired Immunity (natural and adaptive

immune responses); Natural Immunity: Mechanism of barriers to entry of microbes into human body. Physical barriers (skin, mucous); chemical barrier; cellular barriers; inflammation.

In cellular barrier – Monocyte; macrophages – TLR receptors and PAMPS, signal transduction, opsonization, Eosinophils – parasitic infection and role of eosinophils; Basophils, Mast cell; Neutrophils; NK cell.

Inflation - Inflammatory reaction, migration of neutrophils to the site of infection, prostaglandins, leukotriens. Adaptive Immunity: Lymphocytes- (T. cell, B. cell). Dendritic cells; humoral and cell mediated immunity, clonal selection; lymphoid organs.

Antigens – Structure, properties, types, haptens; Antibodies – Structure, types and their biological functions. Hybridoma technology and monoclonal antibody production, application; Antibody engineering Chimeric antibody, Abzymes (catalytic antibody).

Antibody – antigen interactions/techniques – Complement and lytic reaction, complement fixation test, precipitation, immuno diffustion, agglutination, RIA, ELISA immune fluorescence. MHC genes, MHC complex (organization of H_2 + HLA complex, class I and class II MHC molecules). Antigen presenting cells (APC), Antigen processing and presentation (cytosolic and endocytic pathways)

B Cell receptors, maturation, editing, activation and differentiation. T. Cell receptor (?, ?, γ, δ) thymic selection of T. Cell APC – T. Cell interaction, T. Cell activation, super antigens, role of cytokines. Cytoxictiy – T.Cell mediated cytotoxicity, NK cell mediated cytotoxicity, ADCC (antibody directed ecelluar cytotoxicity)

Transplantation Immunology. Tumor Immunology (Tumor antigen, Tumor escape). Immunological disorder – Hypersensitivity (Type I, II, III, IV) Auto Immunity, Immuno deficiencies.

Suggested reading

1. A Text book of Immunology – P. Madhavee Latha.
2. Text book of Immunology – C.A. Bona and FA Bomlla
3. Basic Immunology by Jacqueline Sharon.
4. Immunology by Ivan Roitt, Janathan Brostoff and David Male.

6. Biochemistry

An overview of Biochemistry, cellular environment and applicability of basic laws of chemistry and thermodynamics. Concept of small and macromolecules, molecular interactions and their importance in understanding cellular processes. Monosaccharides and derivatives of sugars, polysaccharides, glycosaminoglycans, proteoglycans, protein glycosylations and its significance.

Primary characterization of proteins, isolation and chromatographic purification of proteins, ultracentrifugation, sequence determination, mass spectrometry. Structure of amino acids and peptide bonds, Ramachandran Plot, alpha helical and beta pleated structures, structures of fibrous proteins like keratin, fibroin, elastin and collagen. Dynamics of protein structure, protein structure, protein stability, globular proteins and maintenance of specific confirmation, structural motifs commonly found in various proteins and their functional relevance. Basic concepts of protein folding, folding pathways, role of accessory proteins in protein folding. Fatty acids, triacylglycerols, glycerophospholipids, sphingolipids, cholesterol lipid bilayers.

Macromolecules:, proteins, polysaccharides, lipids, glycoproteins, glycolipids, lipoproteins, lipopolysaccharides, protein modifications and their functional implications. Enzyme catalysis, specificity of enzyme action, coenzymes and vitamins. Classification of enzymes, factors affecting enzymes activities, feedback and allosteric inhibition. Chemical kinetics and order of reactions, Michaelis and Menten equation, V max and Michaelis constant double reciprocal plots. Mechanisms of acid base, covalent, metal ion catalysis. Types of inhibitions, reversible (competitive, uncompetitive and non-competitive) and irreversible inhibitions, bisubstrate reaction.

Metabolism: basic concepts, central role of ATP in metabolism, carbon fuel and its oxidation, concept of energy rich compounds and intermediates, common types of reactions involved in metabolism. ATP synthesis and chemiosmotic hypothesis of ATP generation. Glycolysis and gluconeogenesis, energetics and ATP productions. Regulation of glycolysis, glycogen synthase, metabolic flux and its regulation by various metabolic intermediates. Different Metabolic Pathways: metabolic versatility of microbes, anaerobic carbon metabolism: anaerobic respiration, sulphate respiration, reference to glycolysis, fermentation – diverse fermentation products, putrefaction, methane oxidizing and methanogenic bacteria, aerobic carbon metabolism: TCA cycle alternative metabolic pathways.

Redox reaction, mitochondrial structure and its role in energy metabolism, electron transport system and oxidative phosphorylation. Pentose phosphate pathway and its importance in biosynthetic reactions. Glycogen synthesis, breakdown and its regulation. Fatty acid biosynthesis and degradation. Amino acid metabolism, urea cycle, one carbon reaction, nonprotein amino acids, amines and their role in cell function. Nucleotide biosynthesis and degradation, salvage pathways, its regulation and diseases.

Suggested reading:

1. Biochemistry (5th Edition) by Jeremy Berg, John Tymoczko and Lubert Stryer.
2. Biochemistry (3rd Edition) by Donald J. Voet and Judith G. Voet.
3. Lehninger Principles of Biochemistry (4 th Edition) by David L. Nelson and Michael M. Cox.

7. Biophysics

Introduction, interaction in biological systems, feedback mechanism. Elementary quantum mechanics and its application in biological system. Biological membrane, movement of ions across cell membrane, electrochemical equilibrium; genesis of membrane potential; properties of excitable membrane; action potential and its propagation, conduction velocity. Voltage clamp, introduction to patch clamp.

Mechanism of muscle contraction, muscle energetics. Lung mechanics, diffusion of gases, surface tension, role of surfactant. Heart and circulatory system, electrical and mechanical

Activity of heart, mechanics of blood flow in blood vessels, cardiac work, and mechanical efficiency of heart. Geometrical optics of vision, refractive defects of eye and its rectification, mechanism of hearing.

Introduction to radiation biology; non-ionising and ionising radiation, isotopes, radiation measurement; radiation hazards, radiation evaluation; control and regulatory aspects of safety. Physical measurements in biology; surface tension, viscosity, diffusion, sedimentation, electrophoresis, diffraction; microscopic techniques, electron microscopy; introduction to NMR.

Use of computers in biology, systems and application, Software, data acquisition system and analysis using software.

8. Biostatistics

Introduction to Biostatistics, Biological Data: Brief history; Population, Variables; Sampling: Representative samples, size of sample, Random & non random samples, stratified samples; Introduction to software used in Biostatistics – SPSS; INSTAT; EXCEL.

Types of Data: Primary and Secondary data; Qualitative and Quantitative; Frequency Distributions; Frequency tables; Presentation of Data: Graphical presentation, Frequency Polygon, Histogram, Bar Diagram, Pie Diagram, Pictogram, Cumulative Frequency curves.

Measures of Central Tendency and Variability: Mean: Arithmetic mean grouped and ungrouped data; Weighted mean; Mode: Grouped and ungrouped data; Median: Grouped and ungrouped data; Range, Standard deviation, variance, coefficient of variation, standard. error.

Normal Distribution: Characteristics; Areas under curve; Z – value.

Probability and Binomial Distribution: Probability: Independent events, addition and multiplication rules, conditional probability; Binomial Distribution.

Correlation and Regression: Bivariate data; Scatter plot; Pearsons correlation coefficient (r): determination and interpretation; Linear regression; Regression coefficient; Fitting regression lines.

Hypothesis Testing: Null and Alternate Hypothesis, Type I and II error; Parametric and nonparametric tests; Tests of Significance, small samples (t – Test), large samples (Z – Test) degree of freedom; X^2 – Test, contingency tables; – levels, interpretation of test results.

ANOVA: One way; Two way; F – Test. **Application and Practice:** HMM; Vital statistics.

Suggested Books for Biostatistics

1. Gould JF and Gould GF, 2001. Biostatistics Basics: A Student Hand Book. W.H.Freeman Co.
2. Campbell RC 1989 – Statistics for Biologists. Cambridge University press.
3. Sokal RR and Rohlf- An Introduction to Biostatistics W.H. Freeman and Co.
4. Bailey NTJ – Statistical Methods in Biology English University Press.
5. Mitchell K & Glover T. Introduction to Biostatistics McGraw Hill Publishing Co.
6. Zor JH – Biostatistical Analysis Prentice Hall Internal Edition.
7. Gupta SP – Statistics methods, Sultan Chand & Sons.

9. Animal Diversity (Animal Life: Form & Function)

Origin and outline classification of non-chordates and chordates (including Onychophora) along with adaptive radiations. Geological time scale and fossils. Minor phyla:- concept of significance (Mesozoa, Echiuroidea, Rotifera, Ctenophora, Rhyncocoela), organization and general characters.

Organization of the coelom:- Acoelomates, pseudocoelomates, coelomates (Protostomia and Deuterostomia); Interrelationships of Hemichordata, Urochordata and Cepahalochordata and their relations with other deuterostomes; Life histories of sessile and pelagic *Pyrosoma, Salpa, Doliolium and Oikopleura.*

Integument:- cuticle, chitin, scales, feathers, hair, dermal glands. Exoskeleton and endoskeleton:- jaw formation, gill arches, chondrocranium. Locomotion:-pseudopodia, flagella and ciliary movements in Protozoa; Hydrostatic movements in coelenterates, annelids, and echinoderms. Fins, wings quadripedal and bipedal locomotion.

Nutrition and Digestion in invertebrates and vertebrates:- patterns of feeding and digestion in lower metazoans; filter feeding in polychaetes, molluscs and echinoderms, amphioxus. Alimentary canal and its modification in vertebrates, Digestive glands.

Respiration in invertebrates and vertebrates; surface, cutaneous, gills, book lungs, trachea, lungs, air sacs, swim bladder.

Excretion Organs of excretion-coelom, nephredia, Malphigian tubules; fish to mammals- protonephridia to metanephridia, modifications of the kidney.

Circulation of body fluids invertebrates to vertebrates, open to closed circulation; evolution of heart and aortic arches; portal system.

Nervous system primitive nervous system- coelenterates and echinoderms; advanced nervous system in annelids, insects, crustaceans and cephalopods. Trends in neural evolution(basic plan to cepahlisation). Vertebrates- evolution of brain.

Reproductive system asexual to sexual in invertebrates and vertebrates; oviparous, ovoviviparous and viviparous. Larval forms of free living invertebrates, larvae of parasites, strategies and evolutionary significance of larval forms.

Suggested Reading Material for Invertebrates

1. Invertebrate Zoology Barnes, RD. W.B. Saunders Co., Philadelphia
2. A Biology of higher invertebrates, Russel-Hunter, WD. McMillan Co. Ltd., London
3. Text book of Zoology. Parker, T.J., Haswell. W.A.Macmillan Co., London.

Suggested Reading Material for Chordates

1. Text book of Zoology. Parker, T.J., Haswell. W.A.Macmillan Co., London.
2. The Biology of Hemichordata and Protochordata. Barrington, E.J.W. Olter and Boyd.Edinborough.
3. Comparative anatomy of vertebrates. Kent. C.G.
4. Chordata morphology. Malcom Jollie. East-West Press Pvt.Ltd., New Delhi.
5. The Chordates. Monielli. A.R.Cambridge University Press. London.
6. Life of Vertebrates, Young. J.Z. The Oxford University Press. London.
7. Elements of Chordate Anatomy, Weichert. C.K. and Presch W. McGraw hall Book Co., NewYork.
8. Chordata structure and function. Waterman. A.J.Macmillan Co. New York.

10. Animal Physiology

Tissue system and their functions: Epithelial tissue, Connective tissue, muscular tissue and Nervous tissue. Principles of physiology: relationship between structure and function, Adaptation, Acclimatization, Acclimation, Homeostasis, Feed-back control systems, Conformity and Regulation. Environmental stress.

Neurophysiology:- ion transport across nerve cell membrane, electrophysiology, conduction of nerve impulse; sensing the environment- photoreceptors, mechanoreceptors, electroreceptor, chemoreceptor, thermoreceptor. Nervous system –CNS and PNS; special senses-eye, ear, smell, taste. Muscle and animal movement: biochemistry of contraction in skeletal, cardiac and visceral muscles; neuromuscular control.

Respiratory system: respiratory pigments, transport of gases in blood, regulation of body pH, respiratory response to extreme conditions like hypoxia, diving and exercise (effect on enzymes and membranes). Physiology of respiration (mammals) and neural regulation breathing.

Circulatory systems: general plan, electrical and mechanical properties of myogenic and neurogenic hearts. Cardiac cycle; regulation of heart beat and blood pressure and electrocardiogram, Haemodynamics; cardiovascular response to extreme conditions like exercise, diving and hemorrhage. Neural regulation of cardiovascular system; peripheral circulation.

Endocrine system: Glands and Hormones: Secretory mechanisms, Endocrine and Neuroendocrine systems in insects and vertebrates. Molecular mechanism of hormone action. Physiological effects of hormones.

Excretion and Osmoregulation- osmoregulators and osmo conformers, obligatory exchanges of ions and water. Osmoregulation in aquatic and terrestrial environment. Physiology of mammalian and nonmammalian kidneys.

Digestive system: Acquisition of Energy:, Digestion (motility and Secretions), Metabolism, and absorption, Physiology of gastrointestinal system (insects and mammals) including neural and hormonal regulatory mechanisms.

Energetics of metabolism expenditure: Body size and metabolic rate, Energetics of locomotion, body rhythms. Thermoregulation: Temperature dependence of metabolic rate, determinants of body heat and temperature, thermal biology of ectotherms, heterotherms and endotherms; hibernation, torpor, aestivation.

Reproductive system: Gametogenesis and its hormonal control, Fertilization, Capacitation; energetics of reproduction.

Suggested reading:

1. Text Book of Medical Physiology (latest edition) by Guyton
2. Animal Physiology: Adaptations and Environment by Knut.S Nielsen.
3. Principles of Anatomy and Physiology by Tortora Gabowski (10^{th} edition or latest).
4. Physiology by Shermann.
5. Comparative Physiology by Prosser and Brown (Latest edition).

11. Animal Developmental Biology

Principle of Developmental biology: Question and Approach in developmental biology, Evaluation of developmental patterns, Principles of experimental embryology, Genomic equivalence. Identification of developmental genes, mutant screening, developmental mutations in Drosophila.

Cleavage and gastrulation: of invertebrates and vertebrates (helminthes, insects, amphibians and mammals) axes and germ layers, cell adhesion.

Phenomenon of organizer: with special reference to amphibians: progressive determination, Regional specificity of induction, Neural tube formation, Cell migration. **General concepts of organogenesis:** Morphogenetic process in epithelia and mesenchyme in organ formation. Morphogenesis of brain, neural crest cells and their accessory organs. Insect imaginal disc – determination of wing and leg imaginal discs, organizing centre in patterning of the wing, butterfly wing development, homeotic selector genes for segmental identity. Development of compound eye, heart and kidney (Ureteric and mesenchymal tubules).

Metamorphosis: Progressive, retrogressive, cyclomorphosis (invertebrate and vertebrate) structural and physiological changes during metamorphosis. **Embryonic Adaptations:** Evolution of cleidoic egg and its structural and physiological adaptations. Development and physiology of extra embryonic membranes in amniotes. Development, types and physiology of mammalian placenta.

Regeneration and differentiation: Types of regeneration – Epimorphic (eg. Salamander limbs), Morphallactic (eg Hydra), Compensatory (eg. Mammalian liver); Morphological and histological processes in amphibian limb regeneration. Origin of cells for regeneration and differentiation. Embryonic stem cells and their applications.

Invertebrate model organisms: *D. melanogaster, C. elegans* – Identification of developmental genes, origin of anterior/posterior and dorsal/ventral patterning, role of

maternal genes, zygotic genes, segmentation genes, gap genes – the paired rule genes, homeotic selector genes. **Vertebrate model organisms:** *X. laevis*, chicken, mammals – Patterning vertebrate of limb, signaling in patterning of limb, homeobox genes in patterning.

Growth–cell proliferation, aging, and cancer genes–involved in timing of senescence.

Suggested reading

1. An introduction to Embryology by Boris Ivan Balinsky.
2. Developmental Biology by Scott F Gilbert.
3. Principles of Development by Tickle, Martinez, Arias Worpert.
4. A text book of General Embryology. Kellicott and William Erskine.

12. Plant Diversity I: Phycology

Principles of classification (Fritz and Smith). Modern trends in taxonomy of Algae (Lee). Emphasis on Prochlorophyta (Prochloron). Diversity in organism and cell structure, thallus and morphological variations. Reproduction and life cycle patterns (in different group of algae). Diversity distribution and Economic importance of algae in industry, agriculture, medicine and food. Role of algae in bioremediation, and mariculture.

Mycology

Principles and modern trends in taxonomy and classification of Fungi. Structure, reproduction and phylogeny of Oomycota, Zygomycota, Ascomycota and Basidiomycota. Diversity distribution and economic importance of fungi (industry, medicine, agriculture including food). General account of Lichens.

Bryophyta

General characters and systems of classification. Contributions of Indian Bryologists. A general account of morphological and anatomical features, reproduction, life history and phylogeny of Liverwort , Hornwort and Mosses. Origin and evolution of Bryophytes, Fossil bryophytes (Brief mention). Diversity distribution and economic importance of bryophytes.

Pteridophyta

General characters, classification (modern trends) and life cycle of Peteriophytes. Structure and evolutionary trends, stele and spore morphology. Telome concept Pteridophytes. Comparative morphology, structure, reproduction and phylogeny of the following Groups: Psilopsida, Lycopsida, Sphaenopsida, Pteropsida. Fossil Pteridophytes-Rhynia, Lepidocarpon, Sphaenophyllum, Zygopteris. Apospory, apogamy and parthenogenesis. Diversity, distribution and economic importance of pteridophytes.

Gymnosperms

General characters, distribution, phylogeny, classification and economic importance of Gymnosperms. Structural details of vegetative and reproductive parts, phylogeny and interrelationships of the following. Cycadofilicales, Caytoniales, Bennettitales, Pentoxylales, Cycadales, Ginkgoales, Coniferales, Gnetales. Diversity distribution and economic importance of gymnosperm.

References

Phycology

1. Bold, H.C. Wynne, M.J. 1985. Introduction to the Algae. Prentice Hall of India, NewDelhi.
2. Chapman, V.J. Chapman, D.J. 1975. The Algae Macmillan India Ltd., Delhi.
3. Fritsch, F.E.1945. Structure and Reproduction of Algae, Cambridge University Press.
4. Kumar, H.D. 1999. Introductory Physiology, Affiliated East West Press Pvt. Ltd. Press.New Delhi.
5. Pandey, B.P.1994. Algae. S. Chand & Company Ltd. New Delhi.
6. Round, F.E. 1984. The Ecology of Algae. Cambridge University Press.

Mycology

1. Ainsworth, G.C., Sparrow. K.E. and Sussman. The Fungi. Academic Press, New York.
2. Alexopoulos, C.J., Mims, C.W. Blackwell, M. 1996. Introductory Mycology. John Wiley & Sons., New York.
3. Bilgarmi, K.S. and Verma, R.N. 1994. Physiology of Fungi. Vikas Publishing HousePvt. Ltd. New Delhi.
4. Dube, H.C. An Introduction to Fungi. Vikas Publishing House, New Delhi.
5. Hale, M.E. 1983. Biology of Lichens. Edward Arnold. – D.D. Awasthi
6. Moore, D.et al., 1986. Developmental Biology of higher Fungi
7. Sharma, O.P. Text book of Fungi. Tata McGraw Hill Publishing Co.Ltd. New Delhi.
8. Webster, J.1975. Introduction to Fungi. Cambridge University Press.
9. Agrawal – Mehrotra.

Bryophyta

1. Cavers, F. 1976. The Inter relationship of the Bryophyta. S.R. Technic (Book House), Ashok Rajpath, Patna.
2. Dyer, A.F. and Duickett, J.G. (Ed.). 1984. The experimental Biology of Bryophytes.Academic Press.
3. Parihar. N.S.1980. An Introduction to Embryophyta Vol. I. Bryophyta. Central Book Depot.
4. Prem Puri, 1981. Bryophytes: Morphology, Growth and differentiation. Atma Ram andSons, New Delhi.

5. Vashishta, P.C. 1999. Bryophyta. S. Chand & Co. New Delhi.

Pteridophyta

1. Eames, E.J. 1983. Morphology of vascular plants. Standard University Press.
2. Rashid, A. 1999. Pteridophyta, Vikas Publishing House Pvt. Ltd. New Delhi.
3. Sharma, O.P. 1990. Textbook of Pteridophyta. Macmillan India Ltd. Delhi.
4. Sporne, K.R. 1986. The morphology of Pteridophytes. Hutchinson University Press.
5. Sundara Rajan, S. 1999. Introduction to Pteridophyta. New Age International Publishers, New Delhi.

Gymnosperms

1. Biswas, C. and Johri, B.M. 1999. The Gymnosperms. Narosa Publishing House, New Delhi.
2. Chamberlain, C.J. 1955. Gymnosperms. Structure and Evolution.
3. Chamberlain, C.J. 2000. Gymnosperms. C B S Publishers and Distributors, New Delhi.
4. Sporne, K.R.1986. Morphology of Gymnosperms. Hutchinson University Press. Vashishta, P.C. 1999. Gymnosperms, S. Chand & Company Ltd. New Delhi.

13. Plant Diversity-II - Taxonomy Of Angiosperms

Definition and importance of taxonomy. History of classification, evolutionary systematics and phylogenic systematics. Basic level including merits and demerits of systems of classification by Bentham and Hooker, Hutchinson and Takhtajan and APG Classification. Contents of ICBN – Author citation – Typification and different types. Publication of names – Rules of Priority-Nomina Conservanda and definitions of nomenclatural terms Autonym, Homonym, Basionym, Tautonym and Nomen. Construction of taxonomic keys (indented and bracketed) and their utilization. Floristic studies in India: Botanical garden and herbarium. Modern concepts and trends in Plant taxonomy: Elementary treatment of; (i) Cytotaxonomy (ii) Chemotaxonomy (iii) Numerical Taxonomy (Taximetries) (iv) Molecular Taxonomy (v) Cladistics. Problems in evolutionary taxonomy: the concepts of primitive and advanced, monophyly and polyphyly, parallelism and convergence, homology and analogy.

Taxonomy

1. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants.
2. Davis, P. H. and Heywood. 1963. Principles of Angiosperm Taxonomy, New York
3. Heslop – Harrison, J. 1958. New concepts in Flowering Plant Taxonomy, London.
4. Heywood, V. H. 1968. Modern methods in Plant Taxonomy.
5. Hutchinson, J. Families of Flowering Plants. Cambridge.
6. Jeffrey, C. 1968. An Introduction to Plant Taxonomy, London.
7. Naik, V.N. 1984. Taxonomy of Angiosperms. New Delhi.
8. Radford Albert, E. Fundamentals of Plant Systematics
9. Sivarajan, V.V. 1991. An Introduction to Principles of Taxonomy, London.
10. Sivarajan, V.V. 1999. Principles of Plant Taxonomy Oxford & IBH Publishing Co.

Pvt Ltd. New Delhi.

14. Plant Physiology

Water relations: water transport processes (diffusion, bulk flow, osmosis, water potential, components of water potential); Mechanism of water transport through xylem; (Ascent of sap) Water loss by transpiration, Solute transport by passive and active mechanisms and membrane transport proteins (Lecithin's); Regulation of water supply. Aquaporins and facilitated water transport; Soil plant Atmosphere continuum (SPAC), concept in stomatal physiology; Signal transduction in guard cells. **Transport processes in plants:** Active and passive transport systems, ion channels, driving forces and flow, transport of nutrients across the primary root, transport through sieve element, Regulation and transport of metabolites from the source to the sink, genetic regulation of transport systems in response to nutrients availability and growth status.

Role of micro and macro elements and assimilations of inorganic nutrients: Essential nutrients, deficiencies and plant disorders. Plant microrrhiza association,; sulfur metabolism, phosphate metabolism, calcium metabolism, assimilation of cations, chloride dynamics. **Nitrogen metabolism:** nitrogen metabolism, nitrogen fixation, assimilatory nitrate reduction, ammonia assimilation and synthesis of amino acids. Regulation of 'nif'. Plant mycorrhiza association.

Photosynthesis: Light absorption, emission, energy transfer, Z scheme of photosynthesis, electron transfer, Role of pigment in transformation of radiant energy. Light harvesting complexes, Kok curve, Kautsky curve, ETS, Photophosphorylation photo inhibition O_2 and H_2 evolution, regulation of Calvin cycle, RUBISCO activity. Photorespiration, CAM, C4 Pathway; Environment and its impact on photosynthesis, agricultural aspects. **Respiration**: Aerobic and anaerobic respiration, EMP pathway, TCA cycle, PPP, Glyoxylate cycle, Mitochondrial ETS, Cyanide resistance pathway, Gluconeogenesis, High energy compounds: Synthesis and utilization, ATP synthesis.

Lipid and other natural product metabolism in plants: Fatty acid biosynthesis, Alpha and Beta oxidation, membrane lipid biosynthesis, lipid desaturation, triacylglycerols, complex lipids, cell wall lipids, alkaloids, ceramides.

Plant growth regulators: Introduction and concept, types of growth regulators Auxin: the master growth hormone, distribution in plants, roles, how auxin works? Auxin mutants, auxin perception, auxin binding proteins, signal transduction, auxin responsive gene/ promoters /factors. Model for gene regulation, derepression of early auxin genes, Acid theory, polar auxin transport, A chemoosmotic model, commercial uses of auxin. **Gibberellins:** Foolish seedling disease, functions of GAs, location, and free verses conjugated Gas, signal transduction and mechanism of action of GAs taking amylase as an example, commercial applications. **Cytokinins:** location, functions and mechanism of action, commercial applications Ethylene: discovery, locations and functions, mutants, mechanism of actions, applications Abscisic acid: discovery, location, functions, mutantsVP1, ABA and ABI, mechanism of action; Introduction of other hormones- brassinosteroids, jasmonic acid and salicylic acid.

Sensory Photobiology: structure and function , photochemical and biochemical properties of phytochrome, Phytochrome induced plant responses, molecular mechanism of action of phytochrome in gene expression, Cryptochrome and its role in photomorphogenesis.

The flowering process: Photoperiodism and its significance, initiation of flower primordia, flowering stimulus Vernalization, endogenous clock and its regulation. Seed Germination; metabolic changes during seed germination, flowering initiation, maturity and fruiting, fruit ripening. **Stress Physiology:** Water deficit and its physiological consequences, drought tolerance mechanisms, salinity stress and plant responses, heat stress and heat shock proteins, metal toxicity, biotic stress, HR and SAR mechanisms.

Plant defenses, role of secondary metabolites: terpenes, phenolic compounds, nitrogen –containing compounds. **Molecular genetics and plant physiology:** Over view, receptors and G. proteins, second messengers, two component sensor regulator systems in bacteria and plants, signal transduction and geneexpression.

REFERENCE BOOKS

1. Devline and Witham, 1986. Plant Physiology. CBS Publs and Distributors, New Delhi.
2. Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley & Sons Inc., New York, USA.
3. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones. Springer Verlag,New York, USA.
4. Singhal *et al.* 1999. Concepts in Photobiology, Photosynthesis and Phyto-morphognesis, Narosa Pub. House, New Delhi.
5. Taiz and Zeiger, 1998. Plant Physiology Sinauer Associates Inc., Publishers, Sunderland
6. Salisbury and Ross, 4th Ed. Plant Physiology Cengage Learning (paperback)

15. Plant Developmental Biology

Model plants for developmental biology: Introduction of model plants used for development studies in plant system, advantages of each system with special emphasis on model plant *Arabidopsis.* **Terms and tools:** Cell division, planes, cell autonomy, cell polarity, radial a/symmetry, pattern formation, abaxial, adaxial identity, cell lineage vs. cell position, meristem, determinant vs. indeterminant meristem, cell ablation technique, temporal and spatial expression of genes*, in situ* hybridization, interacting genes and their position in respect to signaling pathway, targeted mutagenesis in plants, mutant generation and identification of the gene**.**

Reproduction: Male and female gametophyte development, pollination and fertilization. **Seed formation and germination:** Seed formation, cotyledon, endosperm and seed coat development. Seed dormancy and germination, seedling development, genetic regulation of vernalization.

Embryogenesis: Basic lay out of dicot and monocot embryos, stages of embryo development, embryonic axis, cell division and pattern formation in embryo, cell polarity in embryo. **Shoot development:** Structure and function of shoot apical meristem (SAM), initiation and maintenance of SAM, regulation of meristem size, antagonism between SAM and lateral organs, genetic regulation, axial bud formation, shoot branching.

Leaf development: Emergence of leaf primodium from SAM, abaxial and adaxial identity of leaf cells, leaf margin, trichome, epidermis and stomata development, vascular differentiation. **Root development:** Root apical meristem structure and function, lateral root development, lateral and adventitious root development, root hair development, hormonal regulations in root development. **Flower development:** Transition from vegetative to reproductive stage, role of homeotic gene inflorescence meristem, floral whorls specification, ABC model and beyond, whorl boundary specification, asymmetric flower development, structure and development of monocot flowers. **Use of *in vitro* system for studying development**

Suggested reading:

1. The *Arabidopsis* Book, ASPB publication (available freely at www.aspb.org).
2. Biochemistry and Molecular Biology of Plants- Ed. Buchanan, Grussem and Jones, ASPB publication.
3. Plant Physiology by Taiz and Zeiger, Sinauer Associate Inc. Publishers.
4. Plant Physiology – Hopkins.

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6. Ph.D. Mathematics

- **Algebra**

Prerequisites and Preliminaries: Logic, Sets and Classes, Functions, Relations and Partitions, Products, The Integers, The Axiom of Choice, Order and Zorn's Lemma. Groups: Semigroups, Monoids and Groups, Homomorphisms and Subgroups**,** Cyclic Groups, Cosets and Counting, Normality, Quotient Groups, and Homomorphisms, Symmetric, Alternating, and Dihedral Groups, Direct Products and Direct Sums, Free Groups, Free Products, Generators & Relations.

The Structure of Groups: Free Abelian Groups, Finitely Generated Abelian Groups, The Krull-Schmidt Theorem, The Action of a Group on a Set, The Sylow Theorems, Classification of Finite Groups, Nilpotent and Solvable Groups, Normal and Subnormal Series.

Rings: Rings and Homomorphisms, Ideals, Factorization in Commutative Rings, Rings of Quotients and Localization, Rings of Polynomials and Formal Power Series, Factorization in Polynomial Rings.

Fields and Galois Theory: Field Extensions, the Fundamental Theorem, Splitting Fields, Algebraic Closure and Normality, Finite Fields.

Linear Algebra: Vector Space and Linear Transformations, Matrices and Maps, Rank and Equivalence, Determinants, the Characteristic Polynomial, Eigenvectorsand Eigenvalues.

- **Real Analysis**

Sequences and series of functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann-Stieltjes integration, uniform convergence and differentiation, Weierstrass approximation theorem, Power series, uniqueness theorem for power series, Abel's and Tauber's theorems.

Functions of several variables, linear transformations, Derivatives in an open subset of Rn, Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem, Implicit function theorem, Jacobians, extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals, Partitions of unity, Differential forms, Stoke's theorem.

Lebesgue outer measure. Measurable sets. Regularity. Measurable functions. Borel and Lebesgue measurability. Non-measurable sets.

Integration of Non-negative functions. The General integral. Integration of Series. Reimann and Lebesgue Integrals.

Measures and outer measures, Extension of a measure. Uniqueness of Extension. Completion of a measure. Measure spaces. Integration with respect to a measure.The Lp-spaces. Convex functions, Jensen's inequality. Holder and Minkowski inequalities. Completeness of Lp, Convergence in Measure, Almost uniform convergence.

- **Topology**

Countable and uncountable sets. Infinite sets and the Axiom of Choice. Cardinal numbers and its arithmetic. Schroeder-Bernstein theorem. Cantor's theorem and the continuum hypothesis. Zorn's lemma Well-ordering theorem.

Definition and examples of topological spaces. Closed sets. Closure. Dense subsets.

Neighbourhoods. Interior, exterior and boundary. Accumulation points and derivedsets. Bases and sub-bases. Subspaces and relative topology.

Continuous functions and homomorphism, compactness. Continuous functions and compact sets. Basic properties of compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local compactness and one point compactification. Stone-vech compactification. Compactness in metric spaces.

Equivalence of compactness, countable compactness and sequential compactness inmetric spaces, Connected spaces (Connectedness only for metric space.)

- **Functional Analysis**

  Normed linear spaces. Banach spaces and examples. Quotient space of normed linear spaces and its completeness, equivalent norms. Riesz Lemma, basic properties of finite dimensional normed linear spaces and compactness. Weak convergence and bounded linear transformation, normed linear spaces of bounded linear transformations, dual spaces with examples. Uniform boundedness theorem and some of its consequences. Open mapping and closed graph theorems. Hahn-Banach theorem for real linear spaces, complex linear spaces and normed linear spaces.

  Reflexive space. Weak Sequential Compactness. Compact Operators. Solvability of linear equations in Banach spaces, the closed Range Theorem.

  Inner product spaces. Hilbert spaces. Orthonormal Sets. Bessel's inequality. Complete orthonormal sets and Parseval's identity. Structure of Hilbert spaces. Projection theorem. Riesz representation theorem. Adjoint of an operator on a Hilbert space.

  Reflexivity of Hibert spaces. Self-adjoint operators, Positive, projection, normal and unitary operators. Abstract variational boundary-value problem. The generalized Lax-Milgram theorem.

- **Differential Equations**

  Preliminaries-initial value problem and the equivalent integral equation, mth order equation in d-dimensions as a first order system, concepts of local existence, existence in the large and uniqueness of solutions with examples.

  Linear Differential Equations-Linear Systems, Variation of constants, reduction to smaller systems. Basic inequalities, constant coefficients. Adjoint systems, Higherorder equations.

  Dependence on initial conditions and parameters; Preliminaries. Continuity. Differentiability. Higher Order Differentiability.

  Linear second order equations-Preliminaries. Basic facts. Theorems of Sturm. Sturm-Liouville Boundary Value Problems. Number of zeros. Nonoscillatory equations andprincipal solutions. Nonoscillation theorems. Use of Implicit function and fixed point theorems-Periodic solutions. Linear equations. Nonlinear problems.

  Second order Boundary value problems-Linear problems. Nonlinear problems. Aproribounds, Green's Function.

- **Partial Differential Equations**

  Examples of PDE. Classification.

  Transport Equation-Initial value Problem. Non-homogeneous Equation. Laplace's Equation-Fundamental Solution, Mean Value Formulas, Properties of Harmonic Functions, Green's Function, Energy Methods.

Heat Equation-Fundamental Solution, Mean Value Formula, Properties of Solutions, Energy methods. Wave Equation-Solution by spherical Means, Non-homogeneous Equations, Energy Methods.

Nonlinear First Order PDE-Complete Integrals, Envelopes, Characteristics, Hamilton-Jacobi Equations (Calculus of Variations, Hamilton's ODE, Legendre Transform).

Representation of Solutions-Separation of Variables, Similarity Solutions (Plane and Travelling Waves, Solitons, Similarity under Scaling), Fourier and Laplace Transform, Asymptotics (Singular Perturbations, Laplace's Method), Power Series.

Section B - Research Aptitude

The processes broadly involved in undertaking math research: Ability to generalise and particularise, ability to make 'educated guesses' as conjectures, try to prove/disprove theorems. The objectives are

- To assess the understanding of mathematical research processes.
- To assess the inclination and aptitude for undertaking research in mathematics.

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7. Ph.D. Commerce

Course 1: Research Methodology (8 Credits)

1. Theory of Research:

Meaning and Definition of Research, Types of Research, Research Approached (Scientific, Historical, Descriptive, Comparative, Institutional), Criteria of Good Research, Research and Business Decisions, Research Applications in Functional Areas of Business.

2. Research Process :

Problem Selection and Research Design-Selecting a Topic for Research Study, Formulation of Hypothesis, Research Design (Concepts relating to Research Design, Major stops preparing a Research Design, Factors affecting Research Design.)

Techniques of Collecting Qualitative Data (PRA-Participatory Rural Appraisal, RRA - Rapid Rural Appraisal Case Study), Tools of Collecting Qualitative Data (Social Mapping Resource Mapping, Wealth Ranking of the House - holds, Preference Ranking, Focus Group Discussion etc.), Formatting and Processing of Qualitative Data, Sampling Techniques and Sample Design (Methods, Selection of Appropriate Methods and Sampling Criteria), Sampling Tests (Z test, T test, F test). Editing, Coding, Classification and Tabulation Diagrammatic and Graphic Presentation.

3. Analysis of Data (Statistical Application in Research)

Statistics and Business Research Probability Theory, Probability Distributions Percentages and Ratios Measures of Central Tendency Measures of Variability Correlation and Regression Measurement of Trend Association of Attributes Construction of Indices Hypothesis Testing, Scaling Technique

RCO – 002: SPECIALIZATION COURSE (In the selected area of research interest) FOR Ph.D./M.Phil.

Area – 1: Accounting & Taxation ACCOUNTING

Contents

1. Accounting: Information for Decision Making

Accounting Information: A Means to an End User's Perspective - Types of Accounting Information

Accounting Information Forms: - Determining Information Needs - The Cost of Producing Accounting Information, Users of Accounting Information - Objectives of External Financial Reporting - Characteristic of Externally Reported Information - Characteristics and Objectives

Integrity of Accounting Information: Institutional Features - Professional Organizations - Competence, Judgment, and Ethical Behavior.

Accounting Systems: Basic Functions of an Accounting System - Designing and Installation Accounting Systems.

Careers in Accounting: Public Accounting - Management Accounting - Governmental Accounting - Education

2. Presentation and Reporting of Accounting Information

Reporting the Results of Operations: Developing Predictive Information - Reporting Irregular Items Continuing Operations - Discontinued Operations, Extraordinary Items - Changes in Accounting Principles - Earnings per Share (EPS) - Basis and Diluted Earning per Share

3. Statement of Cash Flows

Statement of Cash Flows: Purpose of the statement - Example of a Statement of Cash Flows - Classification of Cash Flows - The Approach to Preparing a Statement of Cash Flows ***Managing Cash Flows:*** Budgeting (The Primary Cash Management Tool - What Priority Should Managers give to Increasing Net Cash Flows?) - Some Strategies for Permanent Improvements in Cash Flow.

4. Financial Statement Analysis

Techniques of financial statement Analysis: Common Size Financial Statements - Financial Statement Analysis Using Common Ratios - Profitability Ratios, Efficiency Ratios, and Solvency Ratios

Tools of Analysis: Trend Percentages, Component Percentages, Ratios, Standards of Comparison, Quality of Earnings, Quality of Assets, and the Relative Amount of Debt

Measures of Liquidity and Credit Risk: A classified Balance Sheet - Working Capital - Current Ratio, Quick Ratio, Debt Ratio - Evaluating Financial Ratios – Liquidity, Credit Risk, and the Law

5. Accounting Standards

Introduction – Accounting Standards in India – Importance of the Accounting Standards – Disclosure of Accounting Policies – Regulations for Valuation of Inventories – Rules for Cash Flow Statement – Norms for Events after Balance Sheet Date – Rules for Provisions and Contingencies – Norms for Net Income and Changes in Accounting Policies – Regulations for Depreciation Accounting – Norms for Revenue Recognition – Accounting for Fixed Assets – Accounting for Taxes on Income – Accounting for Intangible Assets – Norms for Consolidated Financial Statements – Need for Notes to Accounts – Other Accounting Standards – Computerization of Accounts – Indian Companies Providing their Accounts as per US GAAP and IFRS.

6. Global Business and Accounting

Environmental Forces Shaping Globalization - Political and Legal Systems, Economic Systems, Culture, Technology and Infrastructure - Harmonization of Financial Reporting Standards

Foreign Currencies and Exchange Rates: Exchange Rates - Accounting for Transactions with Foreign Companies - Currency Fluctuations – Who Wins and Who Loses? - Consolidated Financial Statements That Include Foreign Subsidiaries

7. Management Accounting

An overview – Concepts and uses - Management Accounting Decision Making Authority - Management Accounting's Role in Decision Making - Management Accounting's Role in Performance Evaluation and Rewards.

8. Costing System and Analysis

Activity Based Costing System: Introduction - Traditional manufacturing Costing System - Activity Based Costing (ABC) and Activity Based Management (ABM) System - Cost of Resource Capacity - ABC for Marketing, Selling and Distribution Expenses - ABC for Service Companies.

Cost variance Analysis: Introduction – Material Variances – Labour Variances – Overhead Variances – Standard Cost Accounting

***Revenue and Profit Variance Analysis**:* Introduction - Sales Variances - Profit Variances - Actual Profit and Budgeted: Reconciliation - Variance Reporting - Disposition of Variances

9. Responsibility Accounting

Introduction – Meaning and Objectives – Types of Responsibility Centres.

Reference text books:

1. Williams, Haka, Bettner (2005) Financial & Managerial Accounting, the basis for business decisions,Tata McGraw-Hill, New Delhi.
2. M. Y. Khan, P. K. Jain (2007) Management Accounting, Text, Problems and Cases, The McGraw-Hill, New Delhi.
3. Asish K. Bhattacharyya (2006) Financial Accounting for Business Managers, Prentice-Hall of India Pvt. Ltd., New Delhi.
4. Robert N Anthony, David F. Hawkins, Kenneth A Merchant (2007) Accounting Text and Cases, TataMcGraw-Hill, New Delhi.
5. N. Ramachandran, Ram Kumar Kakani (2008), Financial Accounting for Management, TataMcGraw-Hill, New Delhi.
6. Shashi K. Gupta (2002), Contemporary Issues in Accounting, Kalyani Publishers, New Delhi.
7. Aggarwal, M.P. (1981), Analysis of Financial Statements, National Publishing House, New Delhi.
8. S.N. Maheshwari (2004), Management Accounting and Financial Control, Sultan Chand and Sons,New Delhi.
9. S.N. Maheshwari, S.K. Maheshwari (2006), Corporate Accounting, Vikas Publishing House Pvt. Ltd.New Delhi.

Taxation

Direct Taxation – Law and Practice

1. ***General Framework of Direct Taxation in India:*** Different direct tax laws and their inter- relationship; Importance of Income Tax Act and Annual Finance Bill Relevant Constitutional provisions; harmonization of tax regime.

2. ***Tax Planning:*** Concept of tax planning; Tax planning with reference to setting up a new business; locational aspects; nature of business; tax holiday, etc. - Tax planning with regard to specific management decisions such as mergers and takeovers; location of undertaking; introduction of voluntary retirement; tax planning with reference to financial management decisions such as borrowing or investment decision; reorganization or restructuring of capital decisions - Tax planning with respect to corporate reorganization; tax planning with reference to employees' remuneration - Tax Planning vis-à-vis important provisions of wealth-tax including court rulings and legislative amendments.

3. ***Tax Management:*** Return and procedure for assessment; special procedure for assessment of search cases, e-commerce transactions, liability in special cases;

collection and recovery of tax; refunds, appeals and revisions; penalties imposable, offences and prosecution.

Indirect Taxation – Law and Practice

4. ***Indirect Taxes:*** Special features of indirect tax levies – all pervasive nature, contribution to Government revenues; constitutional provisions authorizing the levy and collection of duties of central excise, customs, service tax, central sales tax and VAT.

5. ***Central Excise:*** Basis of chargeability of duties of central excise –goods, manufacture, classification and valuation of excisable goods, assessment procedure, exemption, payment, recovery and refunds of duties. Clearance of excisable goods; Central Excise Bonds; maintenance of accounts and records and filing of returns. CENVAT; Duties payable by small scale units. Set-off of duties –concept, meaning and scheme; Central Excise Concessions on exports; search, seizure and investigation; offences and penalty.

6. ***Custom:*** Levy of and exemption from, customs duties – specific issues and case studies; assessment and payment duties; recovery and refund of customs duties; drawback of duties; Confiscation of goods and conveyances and imposition of penalties; search, seizure and arrest, offence and prosecution provisions - Adjudication, Appeal and Revision; Settlement of Cases.

7. ***Service Tax:*** Introduction; Genesis of service tax in India; Constitutional Provisions; Definition of service; Education Cess and Secondary and Higher Education Cess

8. ***Tax Planning and Management:*** Tax Planning, Tax Management, Tax Avoidance and Tax Evasion

Reference text books:

1. Dr. Vinod Kumar Singhania & Dr. Monica Singhania, (2014), Direct Taxes Planning and Management, Taxmann, New Delhi
2. Dr. Vinod Kumar Singhania & Dr. Monica Singhania, (2014), Income Tax including Central Sales Tax, Taxmann, New Delhi
3. R.K. Jain, (2014), Income Tax Planning & Management, Sahitya Bhawan, Agra
4. Dr. P.K. Jain & R.K Tyagi, (2014), Income Tax law & accounts, Sanjay Sahitya Bhawan, Agra
5. R.K. Jain (2014) Excise Customs and Service Tax Case References, Jain Book Depot, New Delhi.

Area 2 – International Business

1. **Basics of International Business Environment** – Social, Cultural, Economic, Political, Demographic, Ecological and Legal Environment.
2. **Balance of Payments** – Concept, Balance of Payments Accounting, Deficit and Surplus, Factors affecting Balance of Payments and Equilibrium and Disequilibrium of Balance of Payments. India's Balance of Payments.
3. **Government Influence on Trade** – Rationale for government intervention, Tariff and Non tariff barriers. Impact of tariff and non tariff barriers on international trade.

4. **Cross Cultural Management** – Hofstede and other studies related to Cross Cultural Managemen
5. **Introduction to Globalization** – Concept, Major forces, Effects of Globalization on the world economy and developing countries, Globalization strategies of Indian Companies, Cross border Mergers and Acquisitions
6. **International Investment** – Concept, Types of International Investment, FDI and Developing Countries, Determinants of FDI, Recent Trends in FDI flows, Trade Related Investment Measures, Multilateral Investment Agreements.
7. **Transnational Corporations** – Features of Transnational Corporations, Recent Trends in Transnational Corporations, Issues And Controversies Of Transnational Corporations. TNCs and Developing Countries.
8. **Technology Transfer** – Rationale of Transfer of Technology, Recent Trends and Current Issues, Non Equity Forms of Technology Transfer, Intellectual Property Rights, India and Transfer of Technology – strategies and challenges.
9. **World Trade** – Recent Trends - composition and direction, Problems of Developing Countries.
10. **International Trade in Services** – Role of Trade in Services in Economic Development, Composition and Direction of International Trade in Services, Challenges of International Trade in Services.
11. **Multilateral Trading System** – Functions and Structure of WTO, Multilateral Trade Agreement and Plurilataral Trade Agreement, India and WTO. Recent issues related to Multilateral Agreements. Impact of Multilateral Trading System on World Trade.
12. **Regional Economic Groupings** – Forms of Regional Groupings, Rationale and Impact of Regional Economic Groupings, Major Regional Economic Groupings - European Union (EU), North American Free Trade Agreement (NAFTA), Association of South etc. East Asian Nations (ASEAN), South Asian Association for Regional Corporation (SAARC)
13. **International Product Planning** – Product Decision, International Product Life Cycle, New Product Development. Product diffusion.
14. **International Branding and Packaging** – Objectives and Advantages, Brand Familiarity Levels, Branding Strategies , Local Brand Vs Global Brand, Impact of Brands on Buying Behaviour, Scope for Indian Brands, Functions and Importance of Packaging, Factors Influencing Packaging Decision, Special Considerations in International Marketing.
15. **International Pricing** – Objectives and factors affecting Pricing Decisions, Pricing Methods and Practices in International Marketing, Transfer Pricing, Counter Trade and Pricing Issues.
16. **International Distribution** – International Channel System, Types of Intermediaries, Factors affecting Channel Choice, Selecting Overseas Agents.
17. **International Marketing Communication** – Promotion Mix, Objectives and Role of International Marketing Communication, Key Issues in International Marketing Communication, Major Marketing Promotion Tools.
18. **International Advertising** – Rationale for International Advertising, Adaptation Vs Standardization, Advertising Appeals and Product Characteristics, Impact of Advertising on buying decisions, Global Media Decisions, Selecting Advertising Agencies, Advertising Regulations, Sales Promotion Tools.
19. **International Retailing** – International Store Operations and Supply Chain Management of Leading International Retailers. International Retail Formats,

International Retail Marketing Strategy.

20. **Emerging Trends and Issues in International Marketing** – E-Marketing, Green Marketing, Digital Marketing, Multilevel Marketing (MLM), Web-based Marketing, and Network Marketing etc.

Further Readings

- WTO Report
- UNCTAD Report
- World Investment Report
- World Economic Survey, etc.

Area 3 – Banking and Finance

1. **Commercial Banks:** Overview of Commercial Banking in India; Role and Functions of Commercial Banks; Indian Banking in Pre, Nationalization and Post, nationalization Phases.
2. **Banking Sectoral Reforms:** Banking Sector Reforms and their Implications on Indian Banking Sector; Changing Role of Indian Banks; Reforms and Restructuring of Banks; Management of Private Sector Banks and Public Sector Banks; Management of Banks in Rural Areas.
3. **Basic Banking Services:** Opening of accounts for companies, trusts, societies, government and public bodies; Importance of AML.
4. **Credit concepts:** Principles of lending; Various credit Products/ Facilities - working capital and term loans; Credit Appraisal Techniques; Approaches to lending; Credit Management, credit monitoring ,NPA Management; Credit Risk Analysis Framework.
5. **Documentation:** Different types of documents; Documentation Procedures; Stamping of documents Securities; Types of collaterals and their characteristics; Priority Sector Lending - Sectors, Targets and Issues/Problems.
6. **Recent Developments:** Agriculture/SMEs/SHGs/SSI/Tiny Sector; Financing New Products & Services: Factoring, Securitization, bancassurance, Mutual Funds, Merchant Banking, Hire Purchase, Securitization, Venture Capital, Leasing and Depository, Credit Cards/Home Loans/Personal Loans/Consumer Loans; IT Application in Banking.
7. **Credit Rating in India:** Concept and reasons of credit rating; Credit rating institutions in India, Limitation of Credit Rating.
8. **Reforms in Banking and Finance:** Reports of the committees; Chakravarty committee, Narsimham Committee I & II :FDI in Banking Sector.
9. **International Banking:** An Overview; Rationale and Scope of International Banking Regulation; Capital Adequacy, loan loss provisioning and other Regulatory Controls.
10. **International Financial System:** An overview; Foreign Exchange Markets; Exchange rate determination; International party theory and Fisher effect; Foreign Exchange Risk Management.
11. **Financial Institutions:** Role of FDI, NBFCs and other International Financial Institutions
12. **Financial Markets:** Structure; Institutions and Operation Mechanism; Money Market in India; Importance; Feature and Instruments; Capital Market in India, New Issues Market and Secondary Market (Stock Exchanges); salient features and operation, changing scenario of Indian Stock Market.

13. **Valuation of Securities:** Equity shares and Bonds valuation models; CAPM, Arbitrary pricing theory.
14. **Corporate Valuation:** Approaches to Corporate Valuation; Restructuring; merger, acquisition and disinvestment leveraged buy-outs.

References

1. Chandra, Prasanna, Financial Management Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007
2. Shapiro Alan C., Multinational Financial Management, Prentice Hall of India Ltd., New Delhi
3. Khan, M.Y. and Jain, P.K., Financial Management Text, Cases and Problems, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007
4. Kishore, Ravi M.: Financial Management, Tax, Delhi.
5. Van Horne, James C., Financial Management and Policy, Prentice Hall of India Ltd., New Delhi Damodaran on Valuation: Security Analysis for Investment and Corporate Finance (Wiley Finance)
6. Neelam C Gulati (2011) Banking and Insurance: Principles & Practices, 3rd edition, Excel Books, Daryaganj New Delhi
7. Gomez Clifford (2011) Banking and Finance: Theory, Law and Practice, 3rd edition, PHI, Daryaganj New Delhi
8. Indian Institute of Banking & Finance (2012): Principles and Practices of Banking, 2nd edition, McMillan, Daryaganj New Delhi.
9. Indian Institute of Banking & Finance (2012): Legal and Regulatory Aspect of Banking 2nd edition, McMillan, Daryaganj New Delhi.
10. N K Sinha (2009): Money Banking and Finance, 5th edition, Bsc Publisher co, Daryaganj, New Delhi.

Area 4: MARKETING MANAGEMNT

1. Defining Marketing for the 21st century

The new marketing realities: Marketing in 21st century, Markerts: Consumer and Organisational markets, Strategic planning & the marketing environment, Current issues in marketing, Marketing research, Buyer behaviour, Segmentation, targeting and positioning, Value capture, Value creation ,Value delivery ,Value communication, Major Societal Forces, New Consumer Capabilities, New Company Capabilities, Integrated Marketing, Internal Marketing, Performance Marketing, Connecting with Customers, Shaping the Market Offerings.

The Demographic Environment and its implication in marketing management: Economic Environment, Social-Cultural Environment, Natural Environment, Technological Environment, Political-Legal Environment.

Creating Customer Value: Satisfaction and Loyalty, Customer Perceived Value (CPV), Total Customer Satisfaction, Monitoring Satisfaction, Maximizing Customer Lifetime Value (CLV), Cultivating Customer Relationships.

Analyzing Consumer Markets: What Influences Consumer Behaviour? Cultural Factors Social Factors, Personal Factors, Key Psychological Processes.

Analyzing Business Markets: Organizational Buying, The Business Market Versus the Consumer Market, Delivering Superior Customer Value, Managing Business-to-Business Customer Relationships, Business Relationships: Risks and Opportunism, Segment Marketing, Niche Marketing, Local Marketing, Balancing Customer and Competitor Orientations. Creating Brand Equity, Building brand equity, Measuring brand equity, devising a branding strategy, crafting brand positioning.

2. Marketing Decisions

Product Decisions:

Setting Product Strategy, Differentiation, Product and brand relationship, The Product Hierarchy, Product Systems and Mixes, Product-Line Analysis

Product-Line Length, Packaging, Labeling, Warranties, and Guarantees.

Designing and Managing Services:

The Nature of Services, Categoreis of Service Mix Distinctive Characteristics of Services, Service Experience , Service Innovation, Service Delivery, Service Quality, service recovery and its implications on business. Managing Service Brands, Developing Brand Strategies for Services, Developing Service Offers for Rural Areas, Manageing Product-Support Services, Identifying and Satisfying Customer Needs, Postsale Service Strategy.

Pricing Decisions:

Developing Pricing Strategies and Programs, Consumer Psychology and Pricing**,** Setting the Price, Adapting the Price, Geographical Pricing (Cash, Countertrade, Barter), Price Discounts and Allowances, Promotional Pricing, Differentiated Pricing, Pricing for Rural Markets, Initiating and Responding to Price Changes, Responding to Comptitiors's Price Changes

Distribution Decisions (logistics decisions):

Designing and Managing Integrated Marketing Channel, Marketing Channels and Value Networks, Channel Integration and Systems, Vertical Marketing Systems,The Importance of Channel Stewards, Horizontal Marketing Systems, Integrating Multichannel Marketing Systems, Conflict, Cooperation, and Competition, Channel Conflict and Competition, Managing Channel Conflict, Dilution and Cannibalization, Legal and Ethical Issues in Channel Relations, Managing Retailing, Wholesaling, and Logistics.

Promotion Decisions:

Communicating Value, Designing and Managing Integrated Marketing Communications, The Changing Marketing Communication Environment, Marketing Communications,

Brand Equity, and Sales, The Communications Process Models, Developing Effective Communications, Celebrity Endorsements as a Strategy, Selecting the Communications Channels, Establishing the Total Marketing Communications Budget, Deciding on the Marketing Communications Mix, Managing the Integrated Marketing Communications Process, Implementing IMC, Managing Mass Communications: Advertising, Sales Promotions, Events and Experiences, and Public Relations, Developing and Manging an Advertising Program, Communicating to the Rural Audience, Deciding on Media and Measuring

Effectiveness, Sales Promotion in Indian market, Events and Experiences, Public Relations, Managing Personal Communications: Direct and Interactive Marketing, Word of Mouth, and Personal Selling, Direct Marketing, Public and Ethical Issues in Direct Marketing, Interactive Marketing, Placing Ads and Promotions Online, Word of Mouth, Buzz and Viral Marketing, Creating successful long term growth.

3. Marketing research

Introduction to Marketing Research, Qualitative and quantitative research methods, Sampling methods, Questionnaire design, reliability and validity. Online survey method, Data preparation and data presentation (graphing), Analysis of Variance (ANOVA) and Analysis of Covariance (ANCOVA), Cluster Analysis, Factor analysis, presenting research information

4. Emerging Trends in marketing:

Rural Marketing, Green marketing, Experiential marketing, Digital Marketing, e-business, Online marketing, Online retailing, Neuroscience and consumer, Sports Marketing, Media marketing and advertising, Brand Management, Innovation and marketing.

Reference Books

- Marketing Management by Arun Kumar and N Meenakshi
- The Rural Marketing Book by Kashyap Raut
- Marketing Management a south Asian Perspective by Philip Kotler, Kevin Lane keler, Abrahamkoshi and Mithileshwar Jha, Pearson Prentice Hall, 2009
- Research Methodology, Concepts and cases by Deepak Chawla and Neena Sondhi, Vikas Publishing House private limited
- Marketing management Ranjan Saxena, Tata McGraw Hill Publishing Company limited
- Marketing management, Cases and Concepts, Nikihilesh Dholakia, Rakesh Khurana, Labdhi Bhandari, Abhinandan K jain, Macmilan India

Area 5: Entrepreneurship and Small Business Management

1. Entrepreneurship and economic development

Entrepreneurship theory and literature: Entrepreneurship in India and abroad, Entrepreneurial motivation (socio- economic factors in entrepreneurship development, basic skills in entrepreneurship), Entrepreneurial environment, Entrepreneurship

development Programme, Entrepreneurial functions, Analysis of barriers in entrepreneurship development, Analysis of success factors of entrepreneurship development.

Entrepreneurship's Importance: Economic impact of entrepreneurial firms, Entrepreneurial Firms' impact on society, Entrepreneurial Firms' impact on larger firms, and Entrepreneurial Firms' impact on overall economic development of a nation Entrepreneurship development.

2. Creativity and Innovation in business

Encouraging creativity at the firm level, protecting ideas from being lost or stolen, IPR, Creation of effective innovation, Market dynamics and new technology, Diffusion and adoption of innovations, Marketing and sales of technology based products and services.

3. Enterprise creation

Screening of ideas, opportunity identification and selection, moving from an idea to an entrepreneurial firm, New enterprise creation: Conceptual and analytical tools to understand, analyze and manage critical aspects of new enterprise, Buisness plan preparation and Analysis, feasibility analysis of business (product/ service feasibility, industry/ market feasibility, organizational feasibility and Financial feasibility analysis, Industry and competitor analysis), Business crisis, Family business management, Small and medium enterprises (threats and opportunities),

Developing an effective Business models:

The importance of business models, how business models emerge, potential fatal flaws of business models.

4. Enterprise Management

- **Small and medium enterprise (managing and growing entrepreneurial firm):**

  Essentials of management principles, its application on enterprise management, planning, importance and application of planning in an organisation, strategic planning and its application.

- **Human resource Management**: recruitment, selection and induction of key employees, training and development, performance appraisals, application of exit interviews etc., Board of directors, Professional advisers, lenders and investors, other professionals.

- **Organisation Behaviour:** Motivation and behavior, designing Motivating jobs, perception, personality, Stress and behavior, Group behavior, Intergroup relations, conflict and its impact on organization, Leadership in organisation, followership, transaction analysis, analysis and application of leadership styles, Organisation structure and design, Organisational change and development, organizational culture and climate.

- **Controlling** (PERT, CPM and other emerging methods to establish control in an organization. Managing human resources and organization development and dynamics, Personnel and Industrial relations, Sources of capital and capitalization process, Venture capitals, Angel investors etc, Intrapreneurship.

5. Micro business development

What are micro businesses, Role of Government in micro business development, Importance of micro businesses in an economy, Micro finance, Self help groups, Direct funding from financial institutions.

6. New Age entrepreneurship

Agri- entrepreneurship, Edu-preneurship (education/academic entrepreneurship), Techno-preneurs (nano techonology, bio technology)

7. Social Entrepreneurship

Social entrepreneurship, social entrepreneurs as change agents, financial sustainability Social entrepreneurship in India and abroad

8. Women Entrepreneurship

State of women Entrepreneurship in India. Barriers to women Entrepreneurship development.

9. Business ethics

Corporate Social responsibility Corporate governance

10. Succession Planning

Business growth and need of succession planning in India. Its role and importance in expansion management.

Reference Books:

- Small Business Management and Entrepreneurship by David Stokes, Nicholas Wilson
- Think and Grow Rich by Napoleon Hill an e-book
- Entrepreneurship and small business management by Norman M Scorborough
- Entrepreneurial Development By Vasant Desai
- Entrepreneurship and entrepreneurial Development by M. Gangadhar Rao
- Organisational Behaviour By Jit S Chandan, Vikas publishing house Private Limited.

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8. Ph.D. Management

The question paper will have the following two parts:

- Research Methodology
- Management (Financial Management, Human Resource Management, Marketing Management, Operations Management and General Management)

The question paper will be objective type and will be of 3 hours duration. The total number of marks will be100 and each part will have a weightage of 50%.

Part 1

Research Methodology

1. Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable.

Research Process

2. Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance
3. Research Design: Concept and Importance in Research – Features of a good research design-Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables
4. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.
5. Measurement: Concept of measurement– what is measured? Problems in measurement in research –Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.
6. Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.
7. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.
8. Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.
9. Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer ScienceDiscipline.
10. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.

Part 2

Management (Financial Management, Human Resource Management, Marketing Management Operations Management and General Management)

I. Managerial Economics – Demand Analysis Production Function
Cost – Output Relations Market Structures Pricing Theories Advertising
Macro – Economics National Income Concepts
Infrastructure – Management and Policy Business Environment Capital Budgeting

II. The concept and significance of organizational behavior – Skills and Roles in an organization – Classical, Neo–Classical and Modern Theories of Organizational Structure–Organizational Design–Understanding and managing individual behavior personality–Perception–Values–Attitudes–Learning–Motivation. Understanding and Managing Group Behavior, Processes–Inter –personal and group dynamics–Communication–Leadership–Managing change–Managing conflicts. Organizational Development.

III. Concepts and perspectives in HRM; HRM in changing environment. Human Resource Plarming–Objectives, Process and Techniques.
Job analysis – Job Description. Selecting Human Resources.
Induction, Training and Development. Exit policy and Implications.
Performance Appraisal and Evaluation. Potential Assessment.
Job Evaluation. Wage Determination.
Industrial Relations and Trade Unions.
Dispute Resolution and Grievance Management. Labour Welfare and Social Security Measures.

IV. Financial Management – Nature and Scope. Valuation Concepts and Valuation of Securities. Capital Budgeting Decisions – Risk Analysis. Capital Structure and Cost of Capital.
Dividend Policy – Determinants.
Long – Term and Short – Term Financing Instruments. Mergers and Acquisitions.

V. Marketing Environment and Environment Scanning; Marketing Information Systems and Marketing Research; Understanding Consumer and Industrial Markets; Demand Measurement and Forecasting; Market Segmentation – Targeting and Positioning; Product Decisions, Product mix, Product Life Cycle; New Product Development; Branding and Packaging; Pricing Methods and Strategies.

Promotion Decisions – Promotion mix; Advertising; Personal Selling; Channel Management; Vertical Marketing Systems; Evaluation and Control of Marketing Effort; Marketing of Services; Customer Relation Management; Uses of Internet as a Marketing Medium – Other related issues like branding, market development, Advertising and retailing on the net. New issues in Marketing.

VI. Role and Scope of Production Management; Facility Location; Layout Planning and

Analysis; Production Planning and Control – Production Process Analysis; Demand Forecasting for Operations; Determinants of Product mix; Production Scheduling; Work measurement; Time and Motion Study; Statistical Quality Control. Supply Chain Management and Materials Management

Role and Scope of Operations Research; Linear Programming; Sensitivity Analysis; Duality; Transportation Model; Inventory Control; Queueing Theory; Decision Theory; Markov Analysis; PERT / CPM.

VII. Probability Theory; Probability distributions – Binomial, Poisson, Normal and Exponential; Correlation and Regression analysis; Sampling theory; Sampling distributions; Tests of Hypothesis; Large and small samples; t z, F, Chi – square tests.

Use of Computers in Managerial applications; Technology issues and Data processing in organizations; Information systems; MIS and Decision making; System analysis and design; Trends in InformationTechnology; Internet and Internet – based applications.

VIII. Concept of Corporate Strategy; Components of Strategy Formulation; Ansoffs Growth Vector; BCG Model; Porter's Generic Strategies; Competitor Analysis; Strategic Dimensions and Group Mapping; Industry Analysis; Strategies in Industry Evolution, Fragmentation, Maturity, and decline.

Competitive strategy and Corporate Strategy; Trans nationalization of World Economy; Managing Cultural Diversity; Global Entry Strategies; Globalization of Financial System and Services; Managing International Business; Competitive Advantage of Nations; RTP and WTO.

IX. Concepts – Types, Characteristics; Motivation; Competencies and its development; Innovation and Entrepreneurship; Small business – Concepts Government policy for promotion of small and tiny enterprises; Process of Business Opportunity Identification; Detailed business plan preparation; Managing small enterprises; Planning for growth; Sickness in Small Enterprises; Rehabilitation of Sick Enterprises; Entrepreneurship (Organizational Entrepreneurship).

X. Ethics and Management System; Ethical issues and Analysis in Management; Value based organisations; Personal framework for ethical choices; Ethical pressure on individual in organisations; Gender issues; Ecological consciousness; Environmental ethics; Social responsibilities of business; Corporate governance and ethics.

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9. Ph.D. Education

(A) Methodology of Educational Research

Sources of acquiring Knowledge, Meaning and Scope of Educational Research, Meaning and steps of Scientific Method, Characteristics of Scientific Method (Replicability, Precision, Falsifiability and Parsimony), Types of Scientific Method (Exploratory, Explanatory and Descriptive), Aims of research as a scientific activity: Problem-solving, Theory Building and Prediction, Types of research (Fundamental, Applied and Action research), Ethical considerations in Research

Criteria and sources of identifying the research problem, Survey, review and importance of related literature, Selection, definition and evaluation of research problem, Writing Objectives

Hypotheses - Concept, Sources, Types (Research, Directional, Non-directional, Null), Formulating Hypothesis, Characteristics of a good hypothesis, Concept of Universe and Sample, Characteristics of a good Sample, Techniques of Sampling (Probability and Non-probability Sampling), Tools of Research - Validity, Reliability and Standardisation of a Tool, Types of Tools (Rating scale, Attitude scale, Questionnaire, Aptitude test and Achievement Test, Inventory), Techniques of Research (Observation, Interview and Projective Techniques)

Variables: Meaning of Concepts, Constructs and Variables, Types of Variables (Independent, Dependent, Extraneous, Intervening and Moderator)

Tools and techniques of data collection - Characteristics of a good research tool Types of research tools and techniques and their use

Major Approaches to Educational Research - Quantitative Research, Qualitative Research and Mixed Methods Research

Methods of Educational Research - Historical research, Descriptive research, Experimental research, Ex postfacto research

Statistical Analysis of Data: Types of Measurement Scale (Nominal, Ordinal, Interval and Ratio), Quantitative Data Analysis - Descriptive data analysis (Measures of central tendency, variability, fiduciary limits and graphical presentation of data), Testing of Hypothesis (Type I and Type II Errors), Levels of Significance, Power of a statistical test and effect size, Parametric Techniques, Non- Parametric Techniques, Inferential data analysis, Use and Interpretation of statistical techniques: Correlation, t-test, z-test, ANOVA, ANCOVA, Chi-square (Equal Probability and Normal Probability Hypothesis). Qualitative Data Analysis - Data Reduction and Classification, Analytical Induction and Constant Comparison, Concept of Triangulation Writing Research Report - Meaning and scope, Format of research reports, Presentation Dissemination.

(B) Subject Specific Areas:

(i) Philosophical and Sociological Foundations of Education

Relationship of Education and Philosophy, Indian and Western Schools of Philosophy and their educational implications; Contributions of Vivekananda, Tagore, Gandhi and Aurobindo to Indian Education; National values as enshrined in the Indian Constitution, and their educational implications; Philosophical Inquiry in Education, Nature and Scope, Steps, Philosophical inquiry of current educational issues.

Education as a social sub-system-specific characteristics: Education and its relationship with modernization and democracy; Education and its relationship with the home, community; Socialization of the child; Meaning and nature of social change: Education as related to social equity and equality of educational opportunities; Constraints on social change in India; Education of the socially and economically disadvantaged sections of the society including students with special needs. Social mobility.

(ii) Learner, Learning Process and Assessment

Growth and Development: Concept and principles, Social, emotional and cognitive development. Individual differences. Personality - Definitions and theories (Freud, Carl Rogers, Gordon Allport, Max Wertheimer, Kurt Koffka), learning styles and their implications on individual in succeeding in his/her learning; Motivation - concept; determinants and types, implications of motivation on learning; Group dynamics and role of teacher in developing positive classroom climate. Mental health and mental hygiene.

Approaches to Intelligence from Unitary to Multiple: Concepts of Social intelligence, multiple intelligence, emotional intelligence Theories of Intelligence by Sternberg, Gardner, Assessment of Intelligence, Concepts of Problem Solving, Critical thinking, Metacognition and Creativity.

Principles and Theories of learning: Behaviouristic, Cognitive and Constructivist theories of learning, Factors affecting learning, learning environment, Concept of social cognition, understanding social relationship and socialization goals.

Assessment – Meaning, nature, perspectives (assessment for Learning, assessment of learning and Assessment as Learning) - Types of Assessment - Placement, diagnostic, formative, summative, Criterion- referenced and Norm-referenced. Relation between objectives and outcomes, Assessment of Cognitive (Anderson and Krathwohl), Affective (Krathwohl) and Psychomotor domains (R.H. Dave) of learning.; Issues in Assessment and Evaluation.

Assessment in pedagogy of education – feedback devices, meaning, types, and criteria. Assessment of Portfolios, Reflective Journal, Field Engagement using Rubrics, Competency Based Evaluation, Assessment of Teacher Prepared ICT Resources, performance-based assessment, issues in assessment and

evaluation.

(iii) Curriculum Studies

Concept and Principles of Curriculum, Strategies of Curriculum Development, Stages in the Process of Curriculum development, Foundations of Curriculum Planning - Philosophical Bases (National, democratic), Sociological basis (socio cultural reconstruction), Psychological Bases (learner's needs and interests), Bench marking and Role of National level Statutory Bodies - UGC, NCTE and University in Curriculum Development

Models of Curriculum Design: Traditional and Contemporary Models (Academic/ Discipline Based Model, Competency Based Model, Social Functions/Activities Model (social reconstruction), Individual Needs and Interests Model, Outcome Based Integrative Model, Intervention Model, Context, Input, Process, Product Model (C I P P Model).

Instructional System, Instructional Media, Instructional Techniques and Material in enhancing curriculum Transaction, Approaches to Evaluation of Curriculum: Approaches to Curriculum and Instruction (Academic and Competency Based Approaches), Models of Curriculum Evaluation: Tyler's Model, Stakes' Model, Scriven's Model, Kirkpatrick's Model Meaning and types of Curriculum change, Factors affecting curriculum change, Approaches to curriculum change, Role of students, teachers and educational administrators in curriculum change and improvement, Scope of curriculum research and Types of Research in Curriculum Studies.

(iv) Educational Management, Administration and Leadership

Educational Management and Administration – Meaning, Principles, Functions and importance, Institutional building, POSDCORB, CPM, PERT, Management as a system, SWOT analysis, Taylorism, Administration as a process, Administration as a bureaucracy, Human relations approach to Administration, Organisational compliance, Organisational development, Organisational climate

Leadership in Educational Administration: Meaning and Nature, Approaches to leadership: Trait, Transformational, Transactional, Value based, Cultural, Psychodynamic and Charismatic, Models of Leadership (Blake and Mouton's Managerial Grid, Fiedler's Contingency Model, Tri-dimensional Model, Hersey and Blanchard's Model, Leader-Member Exchange Theory.

Concept of Quality and Quality in Education: Indian and International perspective, Evolution of Quality: Inspection, Quality Control, Quality Assurance, Total Quality Management (TQM), Six sigma, Quality Gurus: Walter Shewart, Edward Deming, C.K Pralhad

Change Management: Meaning, Need for Planned change, Three-Step-Model of Change (Unfreezing, Moving, Refreezing), The Japanese Models of Change: Just-in-Time, Poka yoke, Cost of Quality: Appraisal Costs, Failure costs and

Preventable costs, Cost Benefit Analysis, Cost Effective Analysis, Indian and International Quality Assurance Agencies: Objectives, Functions, Roles and Initiatives (National Assessment and Accreditation Council [NAAC], Performance Indicators, Quality Council of India (QCI), International Network for Quality Assurance Agencies in Higher Education (INQAAHE).

(v) Educational Technology and ICT

Concept of Educational Technology (ET) as a Discipline: (Information Technology, Communication Technology, Information and Communication Technology (ICT) and Instructional Technology, Application of Educational Technology in formal, non-formal (Open and Distance Learning), informal and inclusive education systems, Overview of Behaviourist, Cognitive and Constructivist Theories and their implications to Instructional Design (Skinner, Piaget, Ausubel, Bruner, Vygotsky), Relationship between Learning Theories and Instructional Strategies (for large and small groups, formal and non formal groups) Systems Approach to Instructional Design, Models of Development of Instructional Design (ADDIE, ASSURE, Dick and Carey Model Mason's), Gagne's Nine Events of Instruction and Five E's of Constructivism, Nine Elements of Constructivist Instructional Design, Application of Computers in Education: CAI, CAL, CBT, CML, Concept, Process of preparing ODLM, Concept of e learning, Approaches to e-learning (Offline, Online, Synchronous, Asynchronous, Blended learning, mobile learning) Emerging Trends in e-learning: Social learning (concept , use of web 2.0 tools for learning, social networking sites, blogs, chats, video conferencing, discussion forum), Open Education Resources (Creative Common, Massive Open Online Courses; Concept and application), e-Inclusion - Concept of e-Inclusion, Application of Assistive technology in E learning , Quality of e-Learning – Measuring quality of system: Information, System, Service, User Satisfaction and Net Benefits (D&M IS Success Model, 2003), Ethical Issues for e-Learner and e-Teacher - Teaching, Learning and Research.

Use of ICT in Evaluation, Administration and Research: E portfolios, ICT for Research - Online Repositories and Online Libraries, Online and Offline assessment tools (Online survey tools or test generators) – Concept and Development.

(vi) Inclusive Education

Inclusive Education: Concept, Principles, Scope and Target Groups (Diverse learners; Including Marginalized group and Learners with Disabilities), Evolution of the Philosophy of Inclusive Education: Special, Integrated, Inclusive Education, Legal Provisions: Policies and Legislations (National Policy of Education (1986), Programme of Action of Action (1992), Persons with Disabilities Act (1995), National Policy of Disabilities (2006), National Curriculum Framework (2005), Concession and Facilities to Diverse Learners (Academic and Financial), Rehabilitation Council of India Act (1992), Inclusive

Education under Sarva Shiksha Abhiyan (SSA), Features of UNCRPD (United Nations Convention on the Rights of Persons with Disabilities) and its Implication Concept of Impairment, Disability and Handicap, Classification of Disabilities based on ICF Model, Readiness of School and Models of Inclusion, Prevalence, Types, Characteristics and Educational Needs of Diverse learners' Intellectual, Physical and Multiple Disabilities, Causes and prevention of disabilities, Identification of Diverse Learners for Inclusion, Educational Evaluation Methods, Techniques and Tools Planning and Management of Inclusive Classrooms: Infrastructure, Human Resource and Instructional Practices, Curriculum and Curricular Adaptations for Diverse Learners, Assistive and Adaptive Technology for Diverse learners: Product (Aids and Appliances) and Process (Individualized Education Plan, Remedial Teaching), Parent-Professional Partnership: Role of Parents, Peers, Professionals, Teachers, School Barriers and Facilitators in Inclusive Education: Attitude, Social and Educational, Current Status and Ethical Issues of inclusive education in India, Research Trends of Inclusive Education in India.

(vii) Educational Guidance and Counselling

Understanding Guidance **-** Meaning and Definitions, Misconceptions about guidance, Need for guidance, Purpose of guidance: self-understanding, self-discovery, self-reliance, self-direction, self-actualization, Scope of guidance programme, Planning Guidance Progrmmes.

Types of Guidance and Group Guidance: Types of Guidance-Educational, Vocational/Career and Personal, Individual guidance and group guidance; advantages of group guidance, Group guidance techniques-class talk, career talk, orientation talk, group discussion, career conference, career corner, bulletin board, role play.

Understanding Counselling **-** Meaning and nature of counselling, Misconceptions about Counselling, Scope of counselling, Goals of counselling: resolution of problems, modification of behaviour, promotion of mental health. Relationship between guidance and counselling: place of counselling in the total guidance programme

Counselling Process and Counselling Relationship - Stages of the counselling process, Counselling Techniques-person centred and group centred, cognitive interventions, behavioural interventions, and systematic interventions strategies. Theories of Counselling, Skills and qualities of an effective counsellor, Professional ethics

Types and Areas of Counselling **-** Uses of group process in counselling, Process of group counselling, Areas of counselling: family counselling, parental counselling, adolescent counselling, counselling of girls, counselling of children belonging to special groups, Peer counselling: Its concept and the relevance to the Indian situation, Steps and skills in group counselling process.

(viii) Teacher Education

Development of Teacher Education in India, NCTE Curricular Frameworks for Teacher Education; Objectives and organization of curriculum of teacher education at various levels; Agencies involved in Pre-service and In-service teacher education; Teacher education through Open and Distance Education; Quality assurance in Teacher Education Programme.

Meaning, Nature and Scope of Teacher Education; Types of Teacher Education Programme, The Structure of Teacher Education Curriculum and its Vision in Curriculum Documents of NCERT and NCTE at Elementary, Secondary and Higher Secondary Levels, Organization of Components of Pre-service Teacher Education Transactional Approaches (for foundation courses) Expository, Collaborative and Experiential learning.

Understanding Knowledge base of Teacher Education from the view point of Schulman, Deng and Luke and Habermas, Meaning of Reflective Teaching and Strategies for Promoting Reflective Teaching, Models of Teacher Education - Behaviouristic, Competency-based and Inquiry Oriented Teacher Education Models

Concept, Need, Purpose and Scope of In-service Teacher Education, Organization and Modes of In-service Teacher Education, Agencies and Institutions of In-service Teacher Education at District, State and National Levels (SSA, RMSA, SCERT, NCERT, NCTE and UGC), Preliminary Consideration in Planning in-service teacher education programme (Purpose, Duration, Resources and Budget)

Concept of Profession and Professionalism, Teaching as a Profession, Professional Ethics of Teachers, Personal and Contextual factors affecting Teacher Development, ICT Integration, Quality Enhancement for Professionalization of Teacher Education, Innovation in Teacher Education.

(ix) Adult Education

Adult Education – Basic concepts and meaning. Adult and Continuing Education -- Pre and Post Independent India, Extension Education and Services in India -- Phases and Movements, Adult Education Perspectives: Asian, Latin American, European and American perspectives

Need, concept, types and characteristics of Lifelong Learning Programme in India, Opportunities for Lifelong Learning and Extension, Agencies in Lifelong Learning in and outside India, Comparative Studies in Adult Education: Parameters, Trends and Analysis

Theoretical and Functional bases of Adult Education -- Liberal, Behaviouristic, Progressive, Humanistic, Radical and Analytical approaches of Adult Education, Social and educational perspectives of Tagore, Gandhi, Vivekananda, Radhakrishnan, Ambedkar and other Indian thinkers

Androgogy and Pedagogy -- Issues of marginalization and pedagogy of women,

tribals, minorities, transgender, aged and persons with disability, Attributes and distinctive features of adult learning and development, Individual Vs. Group learning approaches in Adult Education, Experiences and learning from agriculture, home science, community health and technology, Learning needs of diverse group of adult learners, Recognition of prior learning --Resolving the dilemmas of institutional and non-institutional learning, Theories of adult learning, Professionalization of adult education

Policy Planning and Implementation of Adult Education in India – Five Year Plans, Implementing Agencies– Role of Government Departments, Role of Universities, Colleges and Students, Role of NGOs, Role of Local Bodies, Community and individuals, Understanding Networking in Adult Learning, National Literacy Mission; Objectives, strategies, Total Literacy Campaigns, Post-Literacy Campaigns and Continuing Education Programme, Operationalization of the concept of vocational education in adult, continuing education and Lifelong Learning through state supported structures like Jan Shikshan Sansthan (JSS) and non state supported structures of Industrial and Bussiness houses, Population Education: Concept and paradigm shift Development and its indicators, Millennium Development Goals (MDGs), Sustainable Development Goals (SDGs), Buildin learning communities --Towards a learning society.

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10. Ph.D. Women's Studies

COURSE 1: CONCEPTS AND THERIES IN WOMEN'S STUDIES (8 CREDITS) SYLLABUS

Theme 1: Introducing Women's studies

(a) Emergence of women's studies **–** background and debates in our context and elsewhere. Women's studies as a perspective, debates of autonomy vs. integration. Recent debates and institutional shifts towards Gender studies.

(b) Interrogating Disciplines: Some examples in different fields to show how feminist have questioned and changed the orientations of different disciplines eg. sociology, history, economics, political science, psychology, literature, philosophy. Suggested readings from different disciplines will be included.

(c) Comparative Frameworks: Contextualizing Women's Studies in India -- The subject of "women" in the Indian context – contested terrain of women's studies in relation to the women's movement and feminism. Discussion of the India/West distinction that invariably arises – both in a general situation of third world dependencies on western theories in higher education, but also the specific historical identification of women with Indian culture and hence an association of feminism with the West beginning during the colonial/nationalism period and its legacies. (d)Locating "women" in history: some examples, eg. women and "status" – (social reform, "the status of women" as a local and global indicator.); Women and the nation/culture; Women and development; women and empowerment.

Theme 2: Some Key concepts:

Purpose: To show how certain well known concepts such as patriarchy, or the sex-gender distinction, have been shaped by a set of related concepts – such as status/position, public/private, but also to debates on equality/difference, structure/agency and so on. And secondly, to show the intimate link between such concepts and those of class, caste/race and so on in order to explicate the nature of power.

(a) Power
(b) Equality/Difference
(c) Patriarchy
(d) Sex and gender; debates around women and gender, sexuality / heterosexuality, masculinity / femininity. Gender/class, gender/caste as examples of intersectionality to be dealt with in greater detail later.
(e) Body

Theme 3: Political Economy, State and Citizenship:

Issues of development, class and labour, the nation and the state, have been the most enduring frameworks for locating women and gender, especially in contexts like ours. Some sense of changing problems and debates – eg. Development and globalization; the more recent feminist redefinitions and use of notions of citizenship, etc.

Theme 4: Discrimination, Intersectional ties and Group Identities:

Women and gender issues in relation to questions of caste, tribe, community, and so on will be explored. Comparisons with questions of race and ethnicity are necessary along with questionsof identity and difference, notions of community as well as of intersectionality.

(a) Caste
(b) Tribe
(c) Race/ethnicity
(d) Community
(e) Non-normative Sexualities
(f) Cultural Relativism

Theme 5: Women, Gender and the Family/Household:

This is to locate the significance of the family/household domain – drawing especially from contemporary sociological insights into the changing and diverse forms of the family, kinship and marriage as institutions, property and so on.

(a) Conceptions of Family and Household
(b) Intra-household Inequalities
(c) Critiques of Family and Marriage
(d) Property/inheritance/authority
(e) Labour and the Care Economy

Theme 6: Culture and Representation

The question of culture requires distinct attention, given the immensely critical relationship between women and culture in contexts like ours. This will lead to revisiting of the historical relationship between women and culture and to introduce theories that have interrogated culture,such as those of representation and so on.

(a) Defining culture and representation
(b) Politics of culture
(c) Politics of representation
(d) Institutions and Cultural production
(e) Cultural Production/Technologies

Theme 7: Interrogating Feminisms

Political theories provide us with a standard list of different feminisms – liberal, socialist/Marxist, radical, postmodern and so on. What is the salience of such approaches for us today? How can they be meaningfully analyzed to help students grasp different orientations towards interpreting and questioning contemporary phenomena?

(a) Feminization of Labour Debate - introduce conventional feminist approaches through an example eg. abortion, or labour
(b) Challenges to Normative Feminism – e.g. new practices of veiling, sex worker

movements

(c) Critiques of International Human Rights Discourses e.g. CEDAW, Trafficking, arranged marriage

(d) "Woman" in feminist theory – challenges from marginalized masculinities, blurred gender boundaries, post-feminism.

Theme 8: Concepts/Languages and Translation

This topic addresses an issue that needs more attention than is usually given – that of the language of our concepts and theories. The dominance of English (worldwide and in India) as the language of social science, and of women's studies will be addressed here, in some contrast to the languages of politics, of the movement, of everyday life and of specific fields like literature. What kinds of approaches have been devised to address concepts and theories outside English?

What is the role of translation in this endeavour? Possible notions of bilingualism as productivefor the future of women's studies in our changing context.

The topic will also address approaches to women's relationships to language especially as theyhave been explored in linguistic, literary and psychoanalytical theories.

COURSE 2: FEMINIST RESEARCH METHODOLOGIES (8 CREDITS) SYLLABUS

Themes

1. What is research?
2. Qualitative research
3. Quantitative research
4. Research in the Humanities and Cultural Studies
5. Feminisms and Gender Studies I
6. Feminism and Gender Studies II
7. Thesis writing

Theme 1. What is Research?

a) Epistemology, methodology and method
b) Positivism, the scientific method and its critique
c) Conceptual Issues. (Commonsense and systematic knowledge, Truth and evidence, Objectivity, subjectivity and inter-subjectivity, Contextualisation and intersectionality)
d) Ethics and Research
e) The field and fieldwork

Theme 2. Qualitative Research

a) History and basic features of qualitative research
b) Language, meaning and interpretation
c) Theoretical basis of qualitative research (ethnography, critical social science, grounded theory,narratology, phenomenology, historical and legal studies).

d) Differences between qualitative and quantitative research (Validity, reliability and representativeness)
e) Qualitative data sources. (Legal texts, official documents, field studies, oral narratives and histories, folklore, art and music, novels and other literary sources, the media and the internet). Unit 6. Qualitative research methods (Simple observation and participant observation, FGDs, keyinformant interviews).
f) Qualitative data analysis and presentation (thematising and summarising, content analysis andcoding).

Theme 3. Quantitative Research

a) Comprehending quantitative research
b) The structure of quantitative data
c) Research design and sampling
d) Large macro data sets; indicators and indices
e) Data Collection, Entry, Tabulation and Analysis (Collecting primary data. Questionnaire formulation, coding; Quantifying qualitative data, Collection of Field Data, Cleaning of Data; Cross checking and consistency checks, Coding and recoding, Use of dummy/proxy variables, Basic tables, Use of Statistical Softwares. Excel and SPSS, Reading and Interpreting the results)
f) Basic Measures of data management and Elementary Data Analysis (Measures of central tendency and dispersion, Test of Hypothesis; Types of errors, Acceptance and Rejection Region,Level of Significance, Confidence Interval, Tabular data and measures of association between categorical variables, Concepts of Correlation and Regression; Multivariate data).

Theme 4. Research in the Humanities and Cultural Studies

a) What is Feminist Literary Criticism?
b) Representation (Relationships between Language, Narrative and Experience, Oral culture,Autobiography, Gendering the Gaze in Visual Representation)
c) Discourse Analysis and Ideology
d) Gendered perspectives on Orientalism, Colonialism, Post-Colonialism in Literary and Cultural discourses and cultural Relativism.
e) An introduction to Postmodernism and Feminism Researching wo/man in literary discoursethrough Psychoanalytical and Semiotic theories
f) Queering Feminist Research

Theme 5. Feminism and Gender Studies 1

a) Patriarchal basis of the research process or sexism in research
b) Addressing inequality in research and questioning insider-outsider dichotomy
c) Focus on women's experiences and standpoints (informants as experts)
d) Politically motivated research for social change (consciousness raising)

Theme 6. Feminism and Gender Studies 1I

a) Gender analysis

b) Feminist interviewing and FDG
c) Feminist narratives and textual analysis
d) Feminist action research

Theme 7 Thesis Writing

a) Where to start: library research, online research, web databases, oral sources,fieldwork, other sources
b) How to write: writing style manuals, citing sources, bibliographies, plagiarism, how to write adissertation, writing for research (including how to prepare and present research for academic presentations and publications).

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11. Ph.D. Interdisciplinary and Trans-disciplinary Studies

RITS001: Introduction to Interdisciplinary and Trans disciplinary Studies

1. Knowledge Production and Emergence of Disciplines
2. Disciplinary Approaches: Challenges and Opportunities
3. Interdisciplinary Studies: Nature and Scope
4. Areas of Interdisciplinary Inquiry (Environment, Culture and Civilization, Women and Gender studies, disability, migration and diaspora, labour studies, globalization, sustainable development)
5. Emerging Issues and Challenges
6. Areas of Interdisciplinary Inquiry: The candidate has to select anyone of the specialization area in consultation with supervisor. This course so proposed by research guide shall be approved by the Doctoral Committee and then assigned to the student.

References:

1. Barković, Dražen and et.al. ( ) Challenges of Interdisciplinary Research, Choudry, Aziz (2011) On Knowledge Production, Learning and Research in Struggle, Uniting Struggles: Critical Social Research in Critical Times, http://www.alternateroutes.ca/index.php/ar/article/viewFile/15862/15764
2. Frodeman, Robert et. al. (2017) The Oxoford Handbook of Interdisciplinarity, Oxford University PressGibbons, M. Et. Al. (1994) The New Production of Knowledge, London: Sage
3. Klein, J.T. & Newell, W.H. (1987), Advancing Interdisciplinary Studies, in Jerry Graff & James Ratcliff ,Handbook of the Undergraduate Curriculum, San Francisco: Jossey-Bass, pp. 393-394
4. Kuhn, Thomas (1970) The Structure of Scientific Revolution, Chicago: The University of Chicago
5. Merton, R.K (2002), Science, Technology and Society in Seventeenth Century, England, Fertig, Howard Publisher, ISBN 0865274347

6. Miser, H.J. (1992), Craft in operations research, Operational Research 40 (4), pp. 633-639
7. Müller-Merbach, H. (2008), Interdisciplinary Generalist, Omega, Volume 37, Issue 3, pp. 495-496
8. Weingart, Peter (2017) A Short History of knowledge formations, in Frodeman, Robert et. al. (2017) the Oxford Handbook of Interdisciplinary, Oxford University Press Garrett-Jones, Sam (2007) *Transdisciplinarity and Disciplinarity In The University of The Future,* Unity of Knowledge (In Transdisciplinary Research For Sustainability) – Vol.

RITS002: Research Methods and Techniques

1. Introduction to Social Science Research
2. Types of Research
3. Sources of Data
4. Techniques of Data Collection
5. Ethnography
6. Sampling
7. Research Design
8. Analysis and Interpretation of Data
9. Quantitative Methods
10. Ethics in Research

References:

1. Babbie, E. R. 2007. *The basics of social research* (4th ed.). Australia: Thomson/Wadsworth. 576 pages. Baker, Lynda M. 2001. Review of Understanding Research Methods: An Overview of the
2. Simon, Julian Lincoln. 2003. *Basic research methods in social science: The art of empirical investigation*. New Brunswick, NJ: Transaction Publishers. [Reprint of previous 2nd edition, 1978, entitled Basic research methods in social sciences: The art of empirical investigation.] 558p.
3. Yin, Robert K. 2008. *Case study research: Design and methods.* Applied Social Research Methods Series 5. 4th ed. City, ST: Sage Publications. 240 p

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12. Ph.D. Environmental Science

RESEARCH METHODOLOGY:

Meaning of Research in Environmental Sciences, Characteristics and Types of Research, Hypotheses, Methods of Research, Major emerging areas in environmental sector and interdisciplinary research, problems encountered by researchers in India in the field of Environmental Science. Basic concepts of Techniques of defining research problem; literature review, types of data collection. Basic concepts in analytical techniques of chromatography & spectroscopic methods. Ethical, legal, social and scientific issues in Environmental Science Research. Basic concepts in writing research papers, reports and research proposals. Role of IPR in Research and Development.

Subject areas:

Environmental Chemistry, Environmental Biotechnology, Environmental Geomicrobiology, Environmental management, Natural resource management, Climate change, Sustainability science.

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13. Ph.D. Tourism Studies

The question paper will have the following two parts:

- Research Methodology
- Tourism and Hospitality Services Management

PART I: RESEARCH METHODOLOGY

1. Theory of Research:

Meaning and Definition of Research, Types of Research, Research Approaches, Criteria of Good Research, Research Applications

2. Problem Identification & Formulation:

Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance

3. Research Design:

Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables

4. **Qualitative and Quantitative Research:**

   Qualitative research – Quantitative research – Concept of measurement, causality, generalization and replication.

5. **Measurement:**

   Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.

6. **Sampling:**

   Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability and Non Probability samples. Determining size of the sample – Practical considerations in sampling and sample size. Sampling Tests

7. **Data Analysis:**

   Percentages and Ratios, Measures of Central Tendency, Frequency Distribution, Measures of Variability, Correlation and Regression, Measurement of Trend, Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis.

8. **Interpretation of Data and Paper Writing**

9. **Use of tools / techniques for Research:**

   Methods to search required information effectively, Reference Management Software, Software for detection of Plagiarism.

PART II: Subject Specific

Unit -1

Tourist/Visitors/Travelers/Excursionist-Definition and Differentiation, Tourism recreation and Leisure inter- relationship. Tourism components, Types and Typologies of Tourism

Emerging Concept: Eco / Rural / Agri / Farm / Green / Wildness / Countryside / Special interest tourism

Tourism Trends: Growth and development over the year and factors responsible there in. Changing market destination pattern, traffic flows. Receipt trends. Travel motivator and deterrents. Pull and push forces in tourism.

Linkage and Channels of distribution in tourism

Tourism organization/institutions: Origin, Organization and function of WTO, PATA, IATA, ICAO, FHRAI, TAAI, IATO and UFTAA

Unit -2

Concept of resource, Attraction and product in tourism, Tourism Products: Typology and unique feature

Natural tourism resources in India : Existing use pattern vis-a-vis potential with relation to varied and form (Mountain, deserts, beaches, coastal areas and island), Water bodies and biotic wealth (flora-fauna)

Popular Tourist destination for land based (soft/hard trekking, ice skiing, mountaineering, desert, safaris, carrallies etc), Water Based (rafting, kayaking, canoeing, surfing, waterskiing, scuba/snuba diving) and air based (Para-sailing, Para -gliding, ballooning, hand gliding and micro lightening etc), Tourist activities, Wildlife-Tourism a conservation related issues-Occurrence and distributions of popular wildlife species in India. Tourism national parks. Wildlife centuries and biosphere reserve (case of Dachigham, Corbett/ Dudhva/ Kaxiranga/ kanha/ Gir/ Ranthumbore/ Mudumalai/Sunderbun/Shivpuri/Manas/Nanda Devi/Valley of flower reserve)

Tourism and nature conservation-conflict, symbiosis and Synergy

Cultural Tourism resources in India: Indian culture and Society Indian History-Ancient, Medieval and Modern

Tradition, Customs and costumes, Life Style and settlements patterns, Food habits and cuisines, Music, Musical instruments and Dance Forms. Drawing and Painting, Craftsmanship Religion/Religious observances and important pilgrim destination Architectural Heritage Forts/palace etc.

Unit -3

Accommodation: Concepts, types and typologies, Linkage and Significance with relation to tourism

Emerging dimensions of accommodation industry-Heritage hotels, Motels and resort properties, Time share establishments

Hotel-Origin, Growth and diversification, Classification, registration and gradation of hotels, Organizational Structure, Functions and Responsibilities of the various departments of a standard hotel/other catering outlets, bars, restaurants etc.

Fiscal and non-fiscal incentives available to hotel industry in India, Ethical legal and regulatory aspects

Unit –4

Transportation: Dynamically changing needs and means Landmarks in the development of transport sector and the consequent socioeconomic, cultural and environmental implication, Tourism transport system.

Airlines Transportation: The Airlines Industry-Origin and Growth. Organization of Air Transport Industry. Scheduled and Non Scheduled Airlines services. Role of IATA, ICAO, and other agencies, Bermuda convention.

Air Transports Industry in India- DGCA and other key players, Regulatory framework, Acts, Indian Cariers- Operations Management and Performance, Marketing Strategies of Air India.

Significance of Road Transport in Tourism: Growth and development of road transport system in India, Stateof existing infrastructure, Public and Private Sector involvement Role of Regional Trransport Authority, Approved Travel Agencies, Tour/Transport Operators, Rental Companies

Rail Transport Network-Major Railways system of world-British Rail, Euro Rail and Amtrak

Type of Special Package offered by Indian Railways to tourists-Indrail passes Palace on wheel and royal Orient

Water Transport system in India- History of water transport, Cruise ships, Ferries, Hovercraft, River and canal boats, Fly cruise, Future prospects etc.

Unit -5

Travel Agencies and Tour Operators Business: Origin, Growth and Development, Definition, Differentiation and linkage, Organization and functions, Travel information counseling, Itinerary preparation, reservation, costing/pricing, Marketing of tour package. Income sources

Airlines Ticketing: Operational perspective of ticketing-ABC codes Flight Scheduling, Flying time, and MPM/TPM calculation, TIM (Travel Information Manual), Consultation, Routine and itinerary preparation, Types of fare, fare calculation and rounding up, Currency conversion and payment modes, issuance of ticket

Cargo handling: Baggage allowance, Free Access Baggage, Weigh and Piece Concept,

Accountability of lost baggage, Dangerous goods, Cargo rates and valuation charges, Automation and airport procedures

Requirements for setting up Travel Agency and Tour Operation business

Approval from organization and institution concerned, Incentives available in Indian context, constraint and limitations.

Unit -6

Marketing: Core concepts in marketing, Needs, Wants, Demands, Product market, Marketing

Management Philosophies-Production, Selling, Marketing and social perspective, economic importance of marketing Tourism Marketing: Service characteristics of tourism, unique features of tourist demand and tourist product,Tourism marketing mix Analysis and selection of market: Measuring and forecasting tourism demand, Forecasting method, Managing capacity and demand, Market segmentation and positioning

Developing marketing environment, consumer buying behavior, competitive differentiation and competitive marketing strategies, new product development, product life cycle, Customer satisfaction and related strategies in internal and external marketing, interactive and relationship marketing

Planning marketing Programme : Product and product strategies, Product line, Product mix, Branding and packaging, Pricing Consideration, Approaches and strategies, Distribution channels and strategies

Marketing of Tourism Services: Marketing of Airlines, Hotels, Resort, Travel Agencies and other tourism related services-challenges and strategies

Marketing Skill for Tourism: Creativity-communication-Self motivation-team building, personality development

Unit 7

Tourism Planning: Origin, concept and approaches, Level and types of tourism planning, Product life cycle theories and their applicability in tourism planning, Urban and Rural tourism planning

Tourism planning and policy perspective, planning at national, state and regional levels, India's tourism policies

Tourism Planning process: Objectives, Setting, Background analysis, detailed research and analysis, Synthesis, goal setting and plan formulation, Evaluation of tourism project-Project feasibility study, Plan implementation, Development and monitoring tourism master plan

Tourism impacts and need for sustainable tourism planning: Socio-Cultural, Economic and Physical Impacts, Tourism Carrying Capacity and Environmental Impact Analysis (EIA)

Business ethics and laws-their relevance and applicability in travel and tourism industry Law and legislation relating to tourist entry, stay, departure, Passport, Visa and Health

Tourist safety and security, Preservation and conservation of heritage, Archaeological sites and wildlife.

Unit-8

Management: Concept, Nature, Process and Functions, Management levels, Managerial skills and roles, the external environment, Social responsibilities and ethics

Planning: Nature, Purpose, types and process, Management by objectives, strategies, and

policies, Decision making process, Tools and techniques, Decision making models

Organizing: Concept of organizing and organization, Line and Staff, Authority and responsibility, Span of control, Delegation, Decentralization, conflict and Coordination, organizational structure and design, Management of change innovation and organizational development

Directing: Communication-process, Types, Barriers and principles of effective communication, Motivation -Theories and practices, Leadership-Concept theories and styles

Controlling: Process, Methods and techniques, managing international business

Information systems: Automation of manual system, Data Processing stages, Evolution from EDP to MIS MIS: Introduction, Definition, Status

Computer networking: Application of CRS (computerized reservation System) in travel trade and hospitality sector

Unit-9

Financial Management and Planning:

Finance: Meaning, Goals, Functional, Importance and typologies of finance, Role of financial management, Organizational goal, environment, Forecasting and financial planning, Break even analysis.

Management of current Assets:

Working Capital Management: Meaning and characteristic of working capital, Financing current assets, Cash management, Receivables management and inventory management

Management of fixed Assets: Importance of Capital Budgeting, analytical techniques-non Discounted,Discounted techniques

Financial Structure and Management of Earnings

Meaning, Difference between financial and capital structures, Determinants of financial Structure

Accounting: Preparation of Business Income statement, Balance Sheet, Cash flow statement and Fund flow statement, Hotel Accounting.

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14. Ph.D. Computer Science

PART – 1 (Research Methodology)

Sets, Relations, Functions, Matrices and Determinants, Probability and Statistics, Descriptive and Inferential Statistics, Probability Distributions, Numerical Methods, Finite Differences, NumericalIntegration.

PART – 2 (Computer Science)

2. Computer System Architecture

Digital Logic Circuits and Components: Digital Computers, Logic Gates, Boolean Algebra, Map Simplifications, Combinational Circuits, Flip-Flops, Sequential Circuits, Integrated Circuits, Decoders,Multiplexers, Registers and Counters, Memory Unit.

Data Representation: Data Types, Number Systems and Conversion, Complements, Fixed Point Representation, Floating Point Representation, Error Detection Codes, Computer Arithmetic - Addition, Subtraction, Multiplication and Division Algorithms.

Register Transfer and Microoperations: Register Transfer Language, Bus and Memory Transfers, Arithmetic, Logic and Shift Microoperations.

Basic Computer Organization and Design: Stored Program Organization and Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output, Interrupt.

Programming the Basic Computer: Machine Language, Assembly Language, Assembler, Program Loops, Subroutines, Input-Output Programming.

Microprogrammed Control: Control Memory, Address Sequencing, Design of Control Unit.

Central Processing Unit: General Register Organization, Stack Organization, Instruction Formats,Addressing Modes, RISC Computer, CISC Computer.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Vector Processing Array Processors.

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer,Modes of Transfer, Priority Interrupt, DMA, Serial Communication.

Memory Hierarchy: Main Memory, Auxillary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures, Interprocessor Arbitration, Interprocessor Communication and Synchronization, Cache Coherence, Multicore Processors.

3. Discrete Structures and Optimization

Mathematical Logic: Propositional and Predicate Logic, Propositional Equivalences, Normal Forms,Predicates and Quantifiers, Nested Quantifiers, Rules of Inference.

Sets and Relations: Set Operations, Representation and Properties of Relations, Equivalence Relations,Partially Ordering.

Counting, Mathematical Induction and Discrete Probability: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Inclusion- Exclusion Principle, Mathematical Induction, Probability, Bayes' Theorem.

Group Theory: Groups, Subgroups, Semi Groups, Product and Quotients of Algebraic Structures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory.

Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs, Trees and Rooted Trees, Prefix Codes, Tree Traversals, Spanning Trees and Cut-Sets.

Boolean Algebra: Boolean Functions and its Representation, Simplifications of Boolean Functions.

Optimization: Linear Programming - Mathematical Model, Graphical Solution, Simplex and Dual Simplex Method, Sensitive Analysis; Integer Programming, Transportation and Assignment Models, PERT-CPM: Diagram Representation, Critical Path Calculations, Resource Levelling, Cost Consideration in ProjectScheduling.

4. Programming Languages and Computer Graphics

Language Design and Translation Issues: Programming Language Concepts, Paradigms and Models, Programming Environments, Virtual Computers and Binding Times, Programming Language Syntax, Stages in Translation, Formal Transition Models.

Elementary Data Types: Properties of Types and Objects; Scalar and Composite Data Types.
Programming in C: Tokens, Identifiers, Data Types, Sequence Control, Subprogram Control, Arrays, Structures, Union, String, Pointers, Functions, File Handling, Command Line Argumaents, Preprocessors.

Object Oriented Programming: Class, Object, Instantiation, Inheritance, Encapsulation, Abstract Class, Polymorphism.

Programming in C++: Tokens, Identifiers, Variables and Constants; Data types, Operators, Control statements, Functions Parameter Passing, Virtual Functions, Class and Objects; Constructors and Destructors; Overloading, Inheritance, Templates, Exception and Event Handling; Streams and Files; Multifile Programs.

Web Programming: HTML, DHTML, XML, Scripting, Java, Servlets, Applets.

Computer Graphics: Video-Display Devices, Raster-Scan and Random-Scan Systems; Graphics Monitors, Input Devices, Points and Lines; Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms; Scan Line Polygon Fill Algorithm, Boundary-Fill and Flood- Fill.

2-D Geometrical Transforms and Viewing: Translation, Scaling, Rotation, Reflection and Shear Transformations; Matrix Representations and Homogeneous Coordinates; Composite Transforms, Transformations Between Coordinate Systems, Viewing Pipeline, Viewing Coordinate Reference Frame, Window to View-Port Coordinate Transformation, Viewing Functions, Line and Polygon Clipping Algorithms.

3-D Object Representation, Geometric Transformations and Viewing: Polygon Surfaces, Quadric Surfaces, Spline Representation, Bezier and B-Spline Curves; Bezier and B-Spline Surfaces; Illumination Models, Polygon Rendering Methods, Viewing Pipeline and Coordinates; General Projection Transforms and Cipping.

5. Database Management Systems

Database System Concepts and Architecture: Data Models, Schemas, and Instances; Three-Schema Architecture and Data Independence; Database Languages and Interfaces; Centralized and Client/Server Architectures for DBMS.

Data Modeling: Entity-Relationship Diagram, Relational Model - Constraints, Languages, Design, and Programming, Relational Database Schemas, Update Operations and Dealing with Constraint Violations; Relational Algebra and Relational Calculus; Codd Rules.

SQL: Data Definition and Data Types; Constraints, Queries, Insert, Delete, and Update Statements; Views, Stored Procedures and Functions; Database Triggers, SQL Injection.

Normalization for Relational Databases: Functional Dependencies and Normalization; Algorithms for Query Processing and Optimization; Transaction Processing, Concurrency Control Techniques, Database Recovery Techniques, Object and Object-Relational Databases; Database Security and Authorization.

Enhanced Data Models: Temporal Database Concepts, Multimedia Databases, Deductive Databases, XML and Internet Databases; Mobile Databases, Geographic Information Systems, Genome Data Management, Distributed Databases and Client-Server Architectures.

Data Warehousing and Data Mining: Data Modeling for Data Warehouses, Concept Hierarchy, OLAP and OLTP; Association Rules, Classification, Clustering, Regression, Support Vector Machine, K- Nearest Neighbour, Hidden Markov Model, Summarization, Dependency Modeling, Link Analysis, Sequencing Analysis, Social Network Analysis.

Big Data Systems: Big Data Characteristics, Types of Big Data, Big Data Architecture, Introduction to Map-Reduce and Hadoop; Distributed File System, HDFS.

NOSQL: NOSQL and Query Optimization; Different NOSQL Products, Querying and Managing NOSQL; Indexing and Ordering Data Sets; NOSQL in Cloud.

6. System Software and Operating System

System Software: Machine, Assembly and High-Level Languages; Compilers and Interpreters; Loading, Linking and Relocation; Macros, Debuggers.

Basics of Operating Systems: Operating System Structure, Operations and Services; System Calls, Operating-System Design and Implementation; System Boot.

Process Management: Process Scheduling and Operations; Interprocess Communication, Communication in Client–Server Systems, Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, Synchronization.

Threads: Multicore Programming, Multithreading Models, Thread Libraries, Imp Threading, Threading Issues.

CPU Scheduling: Scheduling Criteria and Algorithms; Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock.

Memory Management: Contiguous Memory Allocation, Swapping, Paging, Segmentation, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files.

Storage Management: Mass-Storage Structure, Disk Structure, Scheduling and Management, RAID Structure.

File and Input/Output Systems: Access Methods, Directory and Disk Structure; File-System Mounting, File Sharing, File-System Structure and Implementation; Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance; Recovery, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations.

Security: Protection, Access Matrix, Access Control, Revocation of Access Rights, Program Threats, System and Network Threats; Cryptography as a Security Tool, User Authentication, Implementing Security Defenses.

Virtual Machines: Types of Virtual Machines and Implementations; Virtualization.

Linux Operating Systems: Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output; Interprocess Communication, Network Structure.

Windows Operating Systems: Design Principles, System Components, Terminal Services and Fast User Switching; File System, Networking.

Distributed Systems: Types of Network based Operating Systems, Network Structure, Communication Structure and Protocols; Robustness, Design Issues, Distributed File Systems.

7. Software Engineering

Software Process Models: Software Process, Generic Process Model – Framework Activity, Task Set and Process Patterns; Process Lifecycle, Prescriptive Process Models, Project Management, Component

Based Development, Aspect-Oriented Software Development, Formal Methods, Agile Process Models – Extreme Programming (XP), Adptive Software Development, Scrum, Dynamic System Development Model, Feature Driven Development, Crystal, Web Engineering.

Software Requirements: Functional and Non-Functional Requirements; Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modelling; Requirements Review, Software Requirment and Specification (SRS) Document.

Software Design: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Cohesion and Coupling; Object-Oriented Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Software Quality: McCall's Quality Factors, ISO 9126 Quality Factors, Quality Control, Quality Assurance, Risk Management, Risk Mitigation, Monitoring and Management (RMMM); Software Reliability.

Estimation and Scheduling of Software Projects: Software Sizing, LOC and FP based Estimations; Estimating Cost and Effort; Estimation Models, Constructive Cost Model (COCOMO), Project Scheduling and Staffing; Time-line Charts.

Software Testing: Verification and Validation; Error, Fault, Bug and Failure; Unit and Integration Tesing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing.

Software Configuration Management: Change Control and Version Control; Software Reuse, Software Re-engineering, Reverse Engineering.

8. Data Structures and Algorithms

Data Structures: Arrays and their Applications; Sparse Matrix, Stacks, Queues, Priority Queues, Linked Lists, Trees, Forest, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree, B* Tree, Data Structure for Sets, Graphs,

Sorting and Searching Algorithms; Hashing.

Performance Analysis of Algorithms and Recurrences:Time and Space Complexities; Asymptotic Notation, Recurrence Relations.

Design Techniques: Divide and Conquer; Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound.

Lower Bound Theory: Comparison Trees, Lower Bounds through Reductions.

Graph Algorithms: Breadth-First Search, Depth-First Search, Shortest Paths, Maximum Flow, Minimum Spanning Trees.

Complexity Theory: P and NP Class Problems; NP-completeness and Reducibility.

Selected Topics: Number Theoretic Algorithms, Polynomial Arithmetic, Fast Fourier Transform, String Matching Algorithms.

Advanced Algorithms: Parallel Algorithms for Sorting, Searching and Merging, Approximation Algorithms, Randomized Algorithms.

9. Theory of Computation and Compilers

Theory of Computation: Formal Language, Non-Computational Problems, Diagonal Argument, Russels's Paradox.

Regular Language Models: Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non- Regular Languages, Lexical Analysis.

Context Free Language: Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA), Context Free Grammar, Chomsky Normal Form, Greibach Normal Form, Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Context Free Grammars; Properties of Context Free Language.

Turing Machines (TM): Standard Turing Machine and its Variations; Universal Turing Machines, Models of Computation and Church-Turing Thesis; Recursive and Recursively- Enumerable Languages; Context-Sensitive Languages, Unrestricted Grammars, Chomsky Hierarchy of Languages, Construction of TM for Simple Problems.

Unsolvable Problems and Computational Complexity: Unsolvable Problem, Halting Problem, Post Correspondence Problem, Unsolvable Problems for Context-Free Languages, Measuring and Classifying Complexity, Tractable and Intractable Problems.

Syntax Analysis: Associativity, Precedence, Grammar Transformations, Top Down

Parsing, Recursive Descent Predictive Parsing, LL(1) Parsing, Bottom up Parsing, LR Parser, LALR(1) Parser.

Semantic Analysis: Attribute Grammar, Syntax Directed Definitions, Inherited and Synthesized Attributes; Dependency Graph, Evaluation Order, S-attributed and L-attributed Definitions; Type- Checking.

Run Time System: Storage Organization, Activation Tree, Activation Record, Stack Allocation of Activation Records, Parameter Passing Mechanisms, Symbol Table.

Intermediate Code Generation: Intermediate Representations, Translation of Declarations, Assignments, Control Flow, Boolean Expressions and Procedure Calls.

Code Generation and Code Optimization: Control-flow, Data-flow Analysis, Local Optimization, Global Optimization, Loop Optimization, Peep-Hole Optimization, Instruction Scheduling.

10. Data Communication and Computer Networks

Data Communication: Components of a Data Communication System, Simplex, Half-Duplex and Duplex Modes of Communication; Analog and Digital Signals; Noiseless and Noisy Channels; Bandwidth, Throughput and Latency; Digital and Analog Transmission; Data Encoding and Modulation Techniques; Broadband and Baseband Transmission; Multiplexing, Transmission Media, Transmission Errors, Error Handling Mechanisms.

Computer Networks: Network Topologies, Local Area Networks, Metropolitan Area Networks, WideArea Network, Wireless Networks, Internet.

Network Models: Layered Architecture, OSI Reference Model and its Protocols; TCP/IP Protocol Suite, Physical, Logical, Port and Specific Addresses; Switching Techniques.

Functions of OSI and TCP/IP Layers: Framing, Error Detection and Correction; Flow and Error Control; Sliding Window Protocol, HDLC, Multiple Access – CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, CDMA, TDMA, Network Devices, Backbone Networks, Virtual LANs.
IPv4 Structure and Address Space; Classful and Classless Addressing; Datagram, Fragmentation and Checksum; IPv6 Packet Format, Mapping Logical to Physical Address (ARP), Direct and Indirect Network Layer Delivery; Routing Algorithms, TCP, UDP and SCTP Protocols; Flow Control, Error Control and Congestion Control in TCP and SCTP.

World Wide Web (WWW): Uniform Resource Locator (URL), Domain Name Service (DNS), Resolution - Mapping Names to Addresses and Addresses to Names; Electronic Mail Architecture, SMTP, POP and IMAP; TELNET and FTP.

Network Security: Malwares, Cryptography and Steganography; Secret-Key

Algorithms, Public-Key Algorithms, Digital Signature, Virtual Private Networks, Firewalls.

Mobile Technology: GSM and CDMA; Services and Architecture of GSM and Mobile Computing; Middleware and Gateway for Mobile Computing; Mobile IP and Mobile Communication Protocol; Communication Satellites, Wireless Networks and Topologies; Cellular Topology, Mobile Adhoc Networks, Wireless Transmission and Wireless LANs; Wireless Geolocation Systems, GPRS and SMS.

Cloud Computing and IoT: SaaS, PaaS, IaaS, Public and Private Cloud; Virtualization, Virtual Server, Cloud Storage, Database Storage, Resource Management, Service Level Agreement, Basics of IoT.

11. Artificial Intelligence (AI)

Approaches to AI: Turing Test and Rational Agent Approaches; State Space Representation of Problems, Heuristic Search Techniques, Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures.

Knowledge Representation: Logic, Semantic Networks, Frames, Rules, Scripts, Conceptual Dependency and Ontologies; Expert Systems, Handling Uncertainty in Knowledge.
Planning: Components of a Planning System, Linear and Non Linear Planning; Goal Stack Planning,Hierarchical Planning, STRIPS, Partial Order Planning.

Natural Language Processing: Grammar and Language; Parsing Techniques, Semantic Analysis and Prgamatics.

Multi Agent Systems: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.

Fuzzy Sets: Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification; Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; Fuzzy Relations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule Based Systems.

Genetic Algorithms (GA): Encoding Strategies, Genetic Operators, Fitness Functions and GA Cycle; Problem Solving using GA.

Artificial Neural Networks (ANN): Supervised, Unsupervised and Reinforcement Learning; Single Perceptron, Multi-Layer Percept.

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15. Ph.D. in Law

Part A- Research Methodology(a) Nature of Research

What is Research? Relevance of Legal ResearchObjective of Legal Research.

Need for Legal Research and Importance of inter-disciplinary approach. Significance of Legal Research in India.

Legal Research as a profession in India.

(b) Types of Research

Doctrinal or Traditional Research. Non-doctrinal or Empirical Research. Descriptive and Analytical Research. Applied and Fundamental Research. Qualitative and Quantitative Research. Law Reform Research.

Historical Research. Sociological Research.

Research Processes

Identification of Research Problems. Review of Literature.
Selection of a Research Problem Formulation of a Hypothesis.
Research Design. Hypothesis.

Research Methods and tools for collection of dataPrimary Data method.

Experimental and Participatory/ Scientific Method. Case Study Method.
Survey Method. Discussion Method. Observation
ethod. Interview Method.
Mail Survey Method.
Questionnaire (Open ended and Close ended) Pilot Study Method.

Secondary Data Method.

Case Law Method. Cumulative Record Cards.

Tabulation and Evaluation of Data. Sampling

Advantages and Limitations of Sampling. Theoretical basis of Sampling
Probability and Non- probability Sampling Classifications of sampling
Simple Random Sampling Stratified Sampling Cluster Sampling Systematic Sampling
Non- random sampling Purposive Sampling Convenience Sampling Judgment Sampling
Sampling and Non- sampling Error.

Analysis and Interpretation of Data

Application of Content Analysis in Legal Research. Analysis of aggregate Data.
Data Interpretation.
Legal input Analysis, the ideal and the practicable.

Data Processing- Summarizing of data, Codification and Tabulation.
Writing a Research Report- Types, Contents and steps involved in drafting of a Report.

Scientific Tools in Research

Jurimetrics.
Use of SPSS and other packages in Legal research. Avoiding/Detecting plagiarism.
Writing the research report/Bibliography/Presentation styles

Other Legal Research Strategies:

Legislative materials including subordinate legislation, notification and policy statements.

Decisional material including foreign decisions; methods of discovering the "rule of the case" -tracing the history of important cases and also to ensuring that the case had not been overruled.

Survey of juristic literature/ writings and its importance in selecting research problem. Compilation of list of reports used or special studies conducted relevant to the problem.

Finding Material in a Law Library: Books, Journals, Law Reports and Digests of cases , Acts, Index to Periodicals.

Mode of Citation and Bibliography: Author- date System, Footnote and Endnote System, Citingfor the First Time, Subsequent citing, List of Abbreviations Used in Citation, Bibliographical Entries, The Bluebook - A Uniform System of Citation.

Part B – Law

Constitutional Law of India

Preamble
Fundamental Rights and Duties. Directive Principles of State Policy. Judiciary.
Executive.
Union State Legislative Relations. Emergency Provisions.
Amendment to the Constitution of India. Writ Jurisdiction.

Legal Theory

Nature and Source of Law.
Positivism, Natural Law Theory, Sociological Jurisprudence. Theories of punishment.
Rights and Duties.
Concepts of Possession and Ownership. Judicial Process and Social Transformation. Judicial Activism.
Social Justice.

Public International Law

Nature of International Law and its relationship with municipal law. Sources of International la
Recognition of states and governments. United Nations.

Settlement of International Disputes.Human rights.

Law of Contracts: General Principles

Essentials of a valid contract.
Offer, acceptance and consideration. Capacity to Contract: Minor's contract.
Elements vitiating contract: Mistake, fraud, misrepresentation, public policy, coercion, undue influence,frustration of contract.
Remedies for breach of contract**:** Damages.

Law of Crimes: General Principles

Nature and Definition of Offence.General Exceptions
Common Intention and Common Object. Criminal Attempt, Conspiracy and Abetment. Offences against Women and child

Law of Torts

Foundation of Tortuous Liability. General Defences to an action of Tort.Vicarious Liability Remoteness of Damages.Negligence Absolute and Strict Liability.

Environmental law

Concept of Environment- Meaning of Environment and Environmental Pollution Environment law for the Prevention and Control of Environmental Pollution in IndiaThe Water (Prevention and Control of Pollution) Act 1974;

The Air (Prevention and Control of Pollution) Act 1981;Wildlife protection Act,1972

Environment protection Act, 1986.

International Development for protection of Environmental Pollution. Remedies for Environmental Protection: Civil, Criminal and Constitutional. Environmental impact assessment and control of Hazardous wastes.

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16. Ph.D. Nursing

Syllabus for entrance test is based on M.Sc. Nursing curriculum with following details:

Research Methodology and Statistics	50 Marks
Nursing management	20 Marks
Nursing Education	20 Marks
Specialization area of Nursing	10 Marks

(Medical Surgical Nursing/Pediatric Nursing /Obstetrics and Gynecology Nursing/ Community HealthNursing/Mental Health and psychiatric Nursing)

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17. Ph.D. Translation Studies

- **Research Methodology**

    - Definitions of Research
    - Objectives of Research
    - Types of Research
    - Significance of Research
    - Preparing Research Proposal
    - Research Approaches
    - Stages of Report writing
    - Using Library resources
    - Style Sheets
    - Data collection and Data Analysis

- **Translation Studies**

    - Meaning, Definitions, Nature and Scope of Translation
    - History of Translation: Western & Indian
    - Translation Studies: Development of Discipline
    - Colonial Translation and Post-Colonial Translation
    - Thinkers of Translation: Nida, J.C. Catford, George Steiner, Itamar E Zohar, Andre Lefevere
    - Issues in Translation

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18. Ph.D. Vocational Education and Training

The syllabus of the Entrance Test shall consists of 50% of research methodology and 50% shall be of Vocational education and training

Part-A: Research Methodology

Introduction to research: meaning of research, role research in behavioral sciences, process of research, types of research, research approach and significance of research.

Formulation of a Research Problem: Research problem: definition, selection and necessity of research problem.

Data Collection Methods: Primary and secondary data, methods of collecting primary data, merits and demerits of different methods of collecting primary data, non-response.

Data Collection Techniques: Designing a questionnaire, pretesting a questionnaire,

editing of primary data, technique of interview, collection of secondary data, scrutiny of secondary data, scale of measurements.

Sampling Techniques: Introduction to sampling, advantage of sampling over census, probability and non- probability sampling and non-sampling error, basics of simple random sampling, stratified random sampling, systematic sampling, and multistage sampling.

Presentation of Data: Classification and tabulation of data diagrammatic and graphical presentation of data. **Statistical Methods**: Measure of Central tendency, measures of dispersion, simple correlation and regression, testing of hypothesis (z, t, F and chi-square tests), Interpretation of data.

Report writing: Formation of Report, Presentation of a report.

References:

1. Elements of Research Methodology and Types of Data Used in Social Research: http://egyankosh.ac.in/bitstream/123456789/26098/1/Unit-13.pdf
2. Types of Research: http://egyankosh.ac.in/bitstream/123456789/26100/1/Unit-12.pdf
3. Research Design: http://egyankosh.ac.in/bitstream/123456789/26096/1/Unit-14.pdf
4. Sampling Methods and Estimation of Sample Size: http://egyankosh.ac.in/bitstream/123456789/26109/1/Unit-15.pdf
5. Measures of Central Tendency: http://egyankosh.ac.in/bitstream/123456789/26108/1/Unit-16.pdf
6. Variance and Standard Deviation: http://egyankosh.ac.in/bitstream/123456789/26106/1/Unit-17.pdf
7. Tests of Significance: http://egyankosh.ac.in/bitstream/123456789/26104/1/Unit-18.pdf
8. Correlation and Regression: http://egyankosh.ac.in/bitstream/123456789/26101/1/Unit-19.pdf
9. Survey Methods and Design: http://egyankosh.ac.in/bitstream/123456789/67343/1/Block-6.pdf
10. Data Analysis and Research Findings: http://egyankosh.ac.in/bitstream/123456789/67345/1/Block-8.pdf

References/Websites/Links for the Entrance-examination for Ph.D. programme;

Part B: Vocational Education and Training

Vocational Education (for Human Recourse Development for National Development, for Knowledge Economy, for Development of Marginalized Sections of the Society, for Persons with Special Needs, Personal/Family Actualisation and Happiness).

International Experiences: Review of International Reports (UNESCO's Report of the International Commission on Education for the Twenty-First Century "Learning: The Treasure Within, Second International Congress on Technical and Vocational Education, Report on Knowledge Acquisition and Skill Development (UNESCO)), International Experiences in Vocational Education (Germany, China, Korea, Japan, Switzerland, Australia, New Zealand).

Growth and Development in India: Historical Background of Vocational Education in India (Pre- Independence Period, Post-Independence Period), Impact of Globalization and Liberalization on Vocational Education. Recent Government of India initiatives on Vocational education, NSQF, VET Programme through formal non-formal modes.

Initiatives by Different Sectors of India: Education Sector (CBSE, State Boards, NIOS and State Open Schools, Community Polytechnics, Jan Shikshan Sansthans, Community Colleges, Degree Colleges and Universities, Open Universities, NCERT and PSSCIVE), Industrial Sector (Craftsman Training Scheme, Apprenticeship Training Scheme, Skill Development Initiative), Health and Paramedical Sector, Agriculture Sector, Business and Commerce Sector, Information and Communication Sector, Role and Work of Non-Governmental Organizations.

Models of Vocational Education and Training: School Based Model (Introduction of VEP in Schools, Thrust Areas Identified by NPE (1986) for VEP, Centrally Sponsored Scheme of Vocationalisation of Education, Programme of Action (POA, 1992), Industry Based Model (Vocational Training Programme), Community Colleges Scheme, Apprenticeship.

Issues in Vocational Educational and Training: Social Acceptability, Access, Terminal Nature of Courses, Employability, Multi-Skilling, Managing a Small Enterprise, Remunerative Structure (wages and earnings) of vocationally trained person

Relevance, Untrained Vocational Teachers, On the Job Training, Apprenticeship Training Assessment and Certification of Prior Learning, Connectivity among Vocational Programme at All Levels, Lateral and Vertical Mobility.

Environmental consciousness and Sustainable Development: Understanding Environment, Environmental Concerns, Environmental Problems and Issues, Major Environmental Problems, Global Environmental Issues (Global Warming, Acid Rain, Ozone Layer Depletion), Environmental Resources (Forest Resources, Land Resources, Water Resources, Animal Resources).

References: For Part B (Vocational Education and Training)

1. https://unevoc.unesco.org/up/India_Country_Paper.pdf
2. https://unevoc.unesco.org/home/TVETipedia+Glossary/filt=all/id=545
3. https://www.aicte-india.org/education/vocational-education
4. https://msde.gov.in/en/schemes-initiatives/apprenticeship-training/naps
5. https://msde.gov.in/en/schemes-initiatives/schemes-initiatives-through-nsdc/udaan
6. https://msde.gov.in/en/organisations/ncvet
8. http://psscive.ac.in/about/psscive
9. http://moef.gov.in/en/environment/pollution/
10. https://nios.ac.in/departmentsunits/vocational-education.aspx
11. https://www.ugc.ac.in/pdfnews/8508026_guidelines-on-b-voc_final.pdf
12. https://www.ugc.ac.in/pdfnews/8083296_B-Vocation-ver-0.4-Final.pdf
13. http://ignou.ac.in/ignou/aboutignou/school/sovet/introduction

19. Ph.D. English

1. British literature: issues and debates, trends and movements
2. Subaltern Literary Perspectives
3. Contemporary World Literature
4. Multiculturalism
5. English Language Teaching
6. New Literatures in English
7. Diaspora Studies
8. Folklore and Culture Studies
9. American Literature
10. Australian Literature
11. Research Methodology
12. Critical Theories
13. Indian Writing in English
14. Canadian Literature

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20. Ph.D. Sanskrit

पीएच.डी. (संस्कृत) प्रवेश परीक्षा का पाठ्यक्रम-

1. शोध प्रविधि
2. वैदिक साहित्य
3. दर्शन साहित्य
4. वेदांग
5. भाषा विज्ञान
6. छंदशास्त्र एव अलंकार
7. काव्यशास्त्र
8. पुराणेतिहास, धर्मशास्त्र
9. अभिलेख शास्त्र
10. भारतीय संस्कृति के तत्व
11. आधुनिक संस्कृत सहित्य

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21. Ph.D. Hindi

1. शोध प्राविधि - शोध का उद्द्शीय और आलोचना शोध के विविध प्रविधियो.
2. हिंदी साहित्य का इतिहास परिस्थितियो प्रवित्तियो एव प्रमुख सहतीयकार.
3. आदिकालीन एव मध्यकालीन कविता.
4. आधुनिक हिंदी कविता (छायावाद, प्रगतिवाद, प्रयोगवाद).
5. नाटक एव अन्य गद्य विधाएँ (स्कंदगुप्त- जयशंकर प्रसाद, आधे-अधूरे-मोहन राकेश, अतीत के चलचित्र- महादेवी वर्मा, किन्नर देश के ओर – राहुल सांक्रत्यायन, अदम्य जीवन- रांगेय राघव, अशोक के फूल और अन्य निबन्ध- हजारी प्रसाद दिवेदी, जूठन – ओमप्रकाश वाल्मीकि)
6. हिंदी उपन्यास (गोदान, बाणभट्ट के आत्मकथा, मैला आँचल, महाभोज), हिंदी कहानी (प्रेमचंद के कहानियाँ, मानसरोवर खंड-1)
7. भाषा विज्ञान और हिंदी भाषा.
8. साहित्य सिद्धांत और समालोचन (काव्य लक्ष्ण, काव्य प्रयोजन, काव्य हेतु, रस सिद्धांत, साधारीकरण. प्लेटो, अरस्तु, लाजाइनसए, क्रोचे, टी. एस. इलियट, आई.ऐ. रिचर्डस, नई समीक्षा, मनोविश्लेषणवादी आलोचना, मार्क्सवादी आलोचना, अस्तित्ववाद, आधुनिकतावाद, उत्तर आधुनिकता, दलित साहित्य और चिंतन(डॉ. अम्बेडकर, ज्योतिबा फुले), अस्मितामूलक विमर्श.

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22. Ph.D. in Child Development

The Entrance examination will be based on what is covered in the syllabus of the M.Sc. Home Science specialization 'Child Development' as well as the relevant components in the UGC-NET syllabus pertaining to the component 'Research Methodology' and the specialization component 'Child Development'. (The specialization 'Child Development' could be referred to by different names in various universities such as Human Development/ Human Development and Childhood Studies/ Human Development and Family Studies).

The outline of the syllabus is as follows:

Paper 1: Research Methodology (50%)

1. Purpose and characteristics of research.
2. Research approaches: quantitative, qualitative and mixed.
3. Positivism and post-positivistic approach to research; nomothetic and idiographic approaches.
4. Steps of research - the research cycle.
5. Research design, sampling and methods of data collection in quantitative, qualitative and mixed methods research.
6. Reliability and validity.
7. Values, Social Responsibility and Ethics in Research.
8. Sources, acquisition, and classification of data.
9. Basic principles and concepts in statistics; Descriptive Statistics; Probability and normal

distribution.

10. Statistical tests - parametric and non -parametric tests of association and difference, regression; interpretation of tests
11. Data analysis and interpretation - quantitative and qualitative data.
12. Graphical representation (bar-chart, histograms, pie-chart, table-chart, and line-chart) and mapping of data.
13. Application of ICT in research

Paper 2: Subject specific: Child Development (50%)

1. Principles of growth and development.
2. Pregnancy and childbirth.
3. Development through the lifespan in various domains (including physical-motor; cognitive, language, socio-emotional development).
4. Theories of child/ human development and behavior; cultural context of human development.
5. Early childhood care and education – curriculum, pedagogy and materials; activities to promote holistic development.
6. Influence of family, peers, school, community and culture on development.
7. Children and persons with disabilities - care and support, early intervention, special education, prevention of disabilities, rehabilitation.
8. Children at risk - child labour, street children, orphaned, abandoned and destitute children, child abuse and trafficking.
9. Adolescence and youth: developmental changes and challenges; Programme to promote optimaldevelopment.
10. Adulthood - characteristics, changing roles and responsibilities in early and middle adulthood.
11. Aging - physical and psychological changes; care, health and psychological needs.
12. Diversity, Disadvantage, Rights and Equity: Policies, Legislation, Strategies and Programme for Intervention and Inclusion
13. Parenting and Society; Counseling for optimal child development.
14. Research Methods in Child Development.

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Annexure-I

Revised Syllabus of IGNOU Ph.D.
Discipline: URDU

نصاب برائے داخلہ (پی۔ ایچ۔ ڈی اردو)
(Syllabus for Ph. D. Urdu Entrance)

1. اردو زبان و ادب کی تاریخ: (Urdu Zaban – O – Adab Ki Tarikh)

- دکن (Deccan)
- شمالی ہند (Shumali - e - Hind)

2. نثری اصناف (Nasri Asnaaf)

(الف) غیر افسانوی اصناف (Ghair Afsanvi Asnaaf)

- خطوط (Khutoot)
- انشائیہ (Inshaiya)
- خاکہ (Khaka)
- رپورتاژ (Reportaz)

(ب) افسانوی اصناف (Afsanvi Asnaaf)

- داستان (Dastan)
- ناول (Novel)
- افسانہ (Afsana)
- ڈراما (Drama)

3. شعری اصناف: (Sheri Asnaaf)

- غزل (Ghazal)
- قصیدہ (Qasida)
- مثنوی (Masnavi)
- مرثیہ (Marsia)
- نظم (Nazm)

4. تنقید: (Tanqeed)

- بیانتی تنقید (Haiati Tanqeed)
- جمالیاتی تنقید (Jmaliyati Tnqeed)
- مارکسی تنقید (Marksi Tanqeed)
- لسانیاتی تنقید (Lisanyati Tanqeed)

5. تحقیق (Tahqeeq) :

- مولانا امتیاز علی خاں عرشی (Maulana Imtiyaz Ali Khan Arshi)
- قاضی عبد الودود (Qazi Abdul Wadood)
- رشید حسن خاں (Rasheed Hasan Khan)
- مالک رام (Malik Ram)
- حنیف نقوی (Hanif Naqvi)

6. ادبی تحریکات اور رجحانات: (Adabi Tahreekaat aur Rujhanat)

- علی گڑھ تحریک (Aligarh Tahreek)
- ترقی پسند تحریک (Taraqqi Pasand Tahreek)
- حلقۂ ارباب ذوق (Halqa-e - Arbaab- e -Zauq)
- جدیدیت (Jadidiyat)