Department of Biochemistry University of Kashmir

SYLLABUS FOR INTEGRATED PH. D PROGRAM COURSE WORK (JAN 2021 onwards)

Paper	Code	Paper Name	Marks
Paper I	BCH-IPHD-	Research	100
-	01	Methodology	
Paper	BCH-IPHD-	Recent advances in	100
II	02	Biochemistry	
Paper	BCH-IPHD-	Specialized Paper*	100
III	03		

*The syllabus for this paper shall be based on the recent developments in the area of research related to the thesis work of the scholar and shall be drafted by the supervisor concerned.

Paper I Research Methodology (BCH IPHD-01)

Unit I - Research design and types

- Meaning and motivation in research i. ii.
 - Importance of literature reviewing in research
 - Sources of Literature review 0
 - Primary and secondary sources 0
 - Reviews, treatise, monographs, patents 0
 - Journals, books and internet recourses 0
 - Identifying research gaps/areas from literature review 0
- iii. Formulating the research problem
 - Selecting and identifying the research problem 0
 - Rationale, originality and significance of research problem identified 0
 - Hypothesis, important considerations while making a hypothesis 0
 - Objectives and aims of research 0
 - Criteria of a good research
- Research process

iv.

- Methods vs Methodology 0
- Time line in research 0
- vi. Types of research
 - Descriptive vs Analytical, 0
 - Applied vs Fundamental 0
 - Quantitative and Qualitative, 0
 - **Conceptual vs Empirical** 0

Unit II - Ethics in research

- Introduction to Bioethics, i.
- Ethical issues concerning various fields of biological research ii.
 - Embryonic stem cells and cloning 0
 - Gene therapy and designer babies 0
 - Genetically modified animals and crops 0

Syllabus for integrated Ph. D program course work (January 2021 onwards)

- Ethical limits of animal use and welfare,
- Medical research ethics
- iii. Academic integrity, reproducibility and publication ethics
 - Plagiarism
 - Tools to check plagiarism
 - Record keeping
 - Responsible authorship and Publications
 - Conflict of interest
 - Mentor and mentee responsibilities and relationships
- iv. Committees
 - Constituting or approaching the ethical/ethics committees,
 - Member and their mandate
 - $_{\circ}$ $\,$ $\,$ Research board, council, and Board of research studies $\,$
 - Statutes and guidelines of uok Ph. D program
- v. Laboratory safety
- vi. Management of laboratory waste

Unit III Statistics in research

- i. Significance of statistics in biological research
- ii. Concepts of data
 - Tools for data collection
 - Data classification
 - Construction of schedules and questionnaires
 - Measurement of scales and indices
 - Pilot Studies and Pre-tests
- iii. Statistical approaches and significance
 - Measures of Central Tendency
 - Measures of dispersion
 - Probability,
 - Binomial distribution,
 - Poisson distribution,
 - \circ Normal distribution.
 - Parametric and non-parametric tests
 - Measures of Association/Relationship
 - Regression and Correlation Analysis
 - Hypothesis Testing (For Proportion and Means)
 - Test of Significance
 - Chi-Square test
 - T-test and F-test
- iv. Sampling Techniques or Methods
 - Choice of Sampling Techniques
 - Sample Size
 - Sampling and Non-Sampling Errors
 - Observation Method
 - Experimentation
 - Simulation
 - Interviewing
 - Panel Method
 - Mail Survey.
- v. Correlation and regression analysis
- vi. Knowledge of ANOVA and SPSS soft wares and their applications
- vii. Processing & Statistical Analysis of Data
 - Editing
 - Classification and Coding
 - Transcription
 - Tabulation
 - $\circ \quad \ \ {\rm Graphical \ Representation}$
- viii. Introduction and use of the statistical software
 - $\circ \quad SPSS$
 - STATA
 - SAS

Unit IV Research techniques

i. Molecular Interactions:

Syllabus for integrated Ph. D program course work (January 2021 onwards)

- Molecular Interaction by proximity labeling: protein-protein, protein-RNA, protein-DNA interactions;
- $_{\circ}$ $\,$ Measurement of genomic interactions and chromatin accessibility:
- Trac looping; eSGA (E.coli synthetic genetic array analysis)
- ii. Microscopy:
 - Cryo-EM;
 - STED super resolved-microscopy;
 - Expansion Microscopy;
 - Light sheet microscopy;
 - Atomic force microscopy;
 - Transmission electron microscopy (TEM)
- iii. Single cell Biology:
 - Single cell genomics;
 - Single cell transcriptomics;
 - Single cell proteomics; G&T Seq:
 - parallel sequencing of single cell genomes and transcriptomes;
 - profiling metabolites and peptides in single cells
 - Yeast Two Hybrid screening, FRET, FREP,
- ii. ChIP, ChIP-Seq, DNA pull down assays,
- iii. Reporter assay (Luciferase reporter assay),
- iv. Microplate capture and detection assay

BCH IP-02- Recent advances in Biochemistry

Unit I- Gene technology

- i. Genome wide sequencing
 - \circ whole genome,
 - Whole transcriptome sequencing
 - Whole exome sequencing
 - Whole epigenome sequencing
 - Cr-Y2H-seq (Cre recombinase-yeast two hybrid-next generation sequencing)
- ii. Genome Wide association studies
- iii. Gene Silencing
- iv. RNA interference:
 - 。 siRNA, micro
 - RNA and shRNA mediated gene silencing, Ribozyme mediated gene silencing;
 - Cre-Lox recombination system in gene knockout approaches,
 - CRISPR-Cas9 in gene silencing and knockout approaches.
 - Genome editing with: CRISPR-Cas9 technology,
 - TALEN system, Zinc finger system
- v. Transgenic plants
- vi.

i.

Unit II Tissue culture

- i. Animal culture
 - Media requirements and sterilization techniques
 - Primary and established cell lines
 - Culture methods
 - $_{\circ}$ $\,$ $\,$ Hanging drop, monolayer and suspension $\,$
 - Advantages and disadvantages of above methods
 - Scale up methods
 - Roux tubes roller bottles
- ii. Stem cells
 - adult and embryonic stems cells
 - application of tissue engineering
 - application of animal cells
- iii. Plant tissue culture
 - $_{\circ}$ $\,$ Cell and callus culture $\,$
 - Anther culture
- iv. Micropropagation
- v. Somatic cell hybridization
- vi. Protoplast fusion cybrids

- vii. Artificial seeds
- viii. Agrobacteria mediated gene transfer and use of Ti Plasmid
- ix. Application of plant tissue culture engineering
 - Pathogen resistance (BT gene) herbicide tolerance
 - salt tolerance

Unit III Drugs and Vaccines

- i. Concept of therapy/treatment and types of therapies
 - Conventional therapy- non-specific: efficacy, limitations
 - Targeted therapy- small molecule and antibody types (Immunological techniques)
 - Concept of Personalized therapy/medicine
 - Gene panel and role of omics in personalized medicine
 - Development of diagnostic panel and markers
 - Omics importance in health and research
 - Approaches

ii.

- Potential of understanding disease biology
- Scope in drug development
- iii. Medicinal plants -Potential sources of medicines
- iv. Approaches in isolation and characterization of novel plant based bioactives
- v. Drug resistance challenges in infections and cancers therapies
- vi. Vaccine development
 - Types, approaches and targets
 - Vaccines scenario for HIV, HPV, influenza, tuberculosis, SARSI/II and Flues)

Unit IV Bioinformatics

- i. Role of bioinformatics
 - Biological research
 - Drug Development
 - Vaccine Development
- ii. Sequence alignments
 - Introduction
 - Protein sequences
 - Pairwise sequence alignment
 - Gaps and Gap-penalties,
 - Scoring matrices
 - o Multiple seq alignment, comparison, composition and properties
 - Useful tools Clustal W, BioEdit, BlastTp,
 - Phylogenetic analysis tools Phylip, ClustalW, Online phylogenetic anlysis
- iii. Biological Bases and uses
 - European Molecular biology laboratory
 - GeneBank
 - Nucleotide Seq databank
 - \circ DNA data bank of japan
- iv. Protein data bases
 - Primary and secondary data bases
 - Database formats
 - $_{\circ}$ structural data bases
 - Protein data bank
 - $_{\circ}$ Molecular model bank
 - Protein protein interaction detection tools and data bases
- v. Tools for primer designs
- vi. Citation management tools
- vii. Mendeley,
 - Easybib.com,
 - \circ Endnote,
 - Read Cube Papers
 - Zotero,
 - RefWorks

Paper I: Research Methodology

Max marks:100

Min marks:50

Time: 3hrs

Unit 1: Biochemical techniques:

Electrophoresis: Agarose gel electrophoresis, native PAGE, SDS-PAGE, 2D gel electrophoresis, Isoelectric focusing. Blotting techniques: Southern, Northern and Western blotting. Far Western blotting, Immunoprecipitation and co-immunoprecipitation. Centrifugation: Principle, types (differential, density gradient) and applications. Ultracentrifugation. Chromatography: Principle and types (Ion exchange and affinity) Basic cell culture techniques, cell viability assays, basic microscopy techniques.

Unit 2: Bioinformatics and Biostatistics:

Bioinformatics: Commonly used sequence formats (FASTA and Swissprot format, European Molecular Biology Laboratory data library format), Sequence alignment (progressive methods of multiple sequence alignment-CLUSTALW, PILEUP)

Biostatistics-Using statistics to summarize Data Sets (mean, mode, median; Sample Variance and Sample Standard Deviation). Testing statistical hypothesis: Hypothesis Tests and Significance Levels; Tests Concerning the mean of a Normal Population: Case of known Variance; The t Test for the mean of a Normal Population: Case of Unknown Variance. Chisquared goodness-of fit tests.

Unit 3: Scientific Writing

Research, Types and Formulations; Meaning of Research, Objectives of Research, Motivation in Research; Research methods vs. Methodology. Types of research-Descriptive vs Analytical, Applied vs Fundamental, Quantitative vs Qualitative, Conceptual vs Empirical; Research Process; Criteria of good Research. Formulating the research problem: Selecting problem: Importance of literature review in research; Sources of literature Review-primary and secondary sources, reviews, treatise, monographs, patents, journals, books and internet resources; Identifying research gap areas from literature review. Hypothesis, important considerations while making a hypothesis.

Unit 4: Research Ethics

Ethics in Research: Introduction to Bioethics. Ethical issues concerning various fields of biology; embryonic stem cells and cloning, gene therapy and designer babies, genetically modified animals and crops. Ethical limits of animal use and welfare. Medical research ethics. Plagiarism and academic integrity. Mentor and mentee responsibilities and relationships. Record keeping, data, responsible authorship and publications. Conflict of interest.

Paper II: Recent Advances in the subject

Max marks: 100 Min marks: 50 Time:3 hrs

Unit 1: Biotechnology and Human Welfare

Gene Cloning: Principle and applications. PCR and types, site directed Mutagenesis. Transformation and transfection. Agri-Biotechnology and healthcare: GM crops, GM crops based products, GE bacteria for agriculture. Genetically engineered pharmaceuticals: human insulin, human growth hormone. Hepatitis B Vaccine, interleukins, AIDS vaccine.

Unit 2: Cell Signalling and Communications

General principles of cell communication. Nuclear receptors, Cytoplasmic receptors. Signally through GPCR receptors. Signaling through enzyme linked cell surface receptors. Ligand Gated Ion Channels. Heat shock and ER stress response. Molecular events in cancer progression. Oncogenes and tumor suppressors. Signaling in plants.

Unit 3: Immunobiology

Generation of antibody diversity and TCR rearrangement. Major histocompatibility complex, Antigen presentation, APCs. T-cell development, negative/Positive selection, Co-stimulatory molecules. Humoral immunity/Cell-mediated immunity, T cell subtypes: Th1, Th2,Th17,Tregs etc. B-cell maturation/activation BCR signalling. Pro inflammatory and anti-inflammatory cytokines. Cell polarization/complement activation (classical/alternate), Vaccines, memory B and T cell responses, active immunization, passive immunization, Vaccine production.

Unit 4: Epigenetics

Eukaryotic genome. Chromatin. Nucleosome structure. Chromatin organization. Different levels of chromatin organization from nucleosome to chromosome territories (including topologically associating domains). Relationship between chromatin organization and gene expression. Modulation of Chromatin structure. Overview of non-coding RNA and their important role in current research. Biogenesis of small ncRNA, piRNA, esiRNA. Long non-coding RNA and their importance in gene regulation.

Syllabus

of

Pre-PhD Course work

for

Bioresources (Scholars)

Batch 2023 onwards

Title: Paper II Recent Advances in Bioresources Maximum Marks: 100

Minimum Marks: 50

Time allowed: 3hrs

Unit I:

Genetic engineering: Introduction, scope and applications; Cloning vectors-Plasmids, cosmids, phages, artificial chromosomes; Expression vectors; Recombinant DNA technology-Restriction enzymes, ligation, transformation and selection; Construction of genomic and cDNA, libraries; Gene transfer methods Molecular markers and their applications, Bacterial genome structure, replication (DNA and plasmid); Genetic exchange (transformation, transduction and conjugation); Recombination (hosts, vectors and mechanism)

Unit II:

Animal cell Culture media, culture procedures and techniques; Transfection, targeted transfection, transient and stable transfections. Large scale culture of cell lines for production of biomolecules (viral vaccines, Interferons, recombinant proteins and hybrid antibodies). Somatic cell fusion, hybridoma technology and production of monoclonal antibodies. Stem cell lines-origin and types, stem cell therapy and its applications. Blood grouping; Rh typing; Immuno electrophoresis; Enzyme linked Immuno Sorbent Assay (ELISA); In vitro fertilization and embryo transfer

Unit III:

Plants as Bioreactors, Transgenic plants for biochemical production (edible vaccines, and secondary metabolites), Modification of plant nutritional content (vitamins, amino acids, lipids, lron), Plant tissue culture (Cellular totipotency; Cell culture and cell cloning) Micropropagation, Production of somatic embryos; synthetic seeds, Somatic hybrids & cybrids.

Unit IV:

Isolation and screening of microorganisms; Cultivation of microbes-nutritional requirements and factors affecting microbial growth (pH, temperature, water, oxygen, CO2); Microbes in beverages and food duction (wine, beer, bread, cheese); Advantages of fermented foods. Major commercial microbial products (amino acids, enzymes, steroids, therapeutic agents and biopolymers); Single Cell Proteins.

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Title: Paper I Research Methodology Maximum Marks: 100

Minimum Marks: 50

Time allowed :3hrs

Unit I: Physical Methods In Biology

Spectroscopy: UV & Visible absorption spetrophotometry, Beer's Lambert Law, Fluorescence Spectroscopy: principles and applications, immunofluorescence Microscopy, Cell and Tissue staining techniques, immunoblotting, Flowcytometry, Chromatography: Partition and Absorption Chromatography, paper and thin layer chromatography, gel filtration, ion-exchange and affinity chromatography. GLC, HPLC. Electrophoresis: Behaviour of bio-macromolecules in electric fields, PAGE, Agarose Gel Electrophoresis, 2D Electrophoresis, Mass spectroscopy technology and its applications. Applied Enzymology: application of enzyme in analytical labs (clinical and industrial), enzymes as industrial catalysts, immobilized enzymes, Abzymes.

Unit II: Biostatistics

Hypothesis testing: Basic concept and procedure, test of difference between means— independent and paired samples, test of proportions and test of goodness of fit. Sampling: Principles and steps in sample survey; simple random sampling, systematic, stratified and cluster sampling. Design and analysis of experiments: Principles, designs— layout, analysis of variance and comparison of treatments in completely randomised design, randomised complete block design and factorial experimental designs. Correlation and regression: Basic idea of correlation; Simple correlation calculation of correlation coefficient; Simple linear regression— calculation of regression

Unit III: Scientific Writing

Research, Types and formulations; Meaning of Research, Objectives of Research, Motivation in Research; Research methods Vs. Methodology, Types of research-Descriptive Vs. analytical, applied Vs. Fundamental, Quantitative Vs. Qualitative, Conceptual Vs. Empirical; Research Process; Criteria of Good Research. Formulating the research problem; Selecting the problem; Importance of literature review in research; Sources of Literature Review-Primary and secondary sources reviews (treatise, monographs, Patents, Journals, books and Internet resources; Identifying research gap areas from literature review, Hyopothesis, important considerations while making a hypothesis.

Unit IV: Research Ethics

Ethics in Research ; Introduction to Bioethics, Ethical issues concerning various fields of biology; Embryonic stem cells and cloning ;gene therapy and designer babies, genetically modified animals and crops, Ethical limits of animal use and welfare . Medical research ethics , plagiarism and academic integrity , Mentor and mentee responsibilities and relationships , Record keeping , data , responsible , authorship and publications, conflict of interest.

Minimum Marks: 50

Time allowed :3hrs

Unit 1: An introduction to cancer

Title: Paper III Animal Sciences

ximum Marks: 100

Introduction to cancers, Types of cancer, causes and risk factors of cancers, properties of cancer cells, Tumor genetics: mutations, carcinogenic agents, tumor genes, defects in DNA repair. DNA damage markers. Tumor epigenetics: imprinting, DNA methylation, Oncogenes and tumorsuppressor genes, Cancer metastasis, Treatment options for cancer; Radiotherapy, chemotherapy, immunotherapy, therapy. combination targeted ' therapy and

Unit II: An introduction to breast cancer

Introduction to breast cancer: causative factors and Risk Factors of Breast Cancer, classification of breast cancer; types and molecular subtypes of breast cancer, stages of breast cancer, Novel biomarkers of breast cancer. Diagnosis of breast cancer. Treatment modalities for breast cancer; Radiotherapy, chemotherapy, immunotherapy, targeted therapy combination therapy. Breast and cancer metastasis. Types of breast cancer cell lines: TNBC cell lines, ER+ cell lines, PR+ cell, HER2+ lines, cell lines, normal < human cell lines.

Unit III: Signaling pathways in breast cancer

An introduction to the signal transduction pathways involved in the progression of cancer, role of different signalling pathways in breast cancer; Importance of PI3K/mTOR /AKT pathway in breast cancer. NF-Kappa signalling pathway in breast cancer, TGF-beta signalling pathway, notch signalling pathway breast in cancer. Anticancer therapies targeting · the signalling pathways involved in the tumorigenesis of breast cancer.

Unit IV: Cell cycle dysregulation in breast cancer

An introduction to cell cycle, Phases of cell cycle, cell cycle regulators, CDs in cell cycle; Role of CDKs in different phases of cell cycle, CDK4/CDK6-RB pathway, cell cycle dysregulation in breast cancer, CDKs in breast cancer, role of CDK inhibitors in breast cancer; CDK1/2 inhibitors, CDK4/6 inhibitors, and novel CDK inhibitors in breast cancer.

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Title: Paper III PlatSciences Maximum Marks: 100

Minimum Marks: 50

Time allowed :3hrs

& Unit 1:

Introduction: Abiotic and Biotic stresses in plants, Osmoprotectants, Dehydrins, HSP, Signal T transduction in plants (General features): species Reactive oxygen (Role, Types and generation).Defence mechanisms in plants (Non enzymatic, Enzymatic): Plant Immunity (Role of NO and ROS); Hypersensitivity vs pathogenicity (HR, SAR);Role of CDPK and MAPK , Phosphoinositides (PI), plant stress: Abscisic acid; Brassinosteroides; Jasmonic acid; Ethylene Phytohormones in

Unit II:

Plant-microbe interactions: Bacterial plant pathogens and symbionts (Legume-Rhizobium symbiosis), competition among Nodulation; of nitrogenase, components Nitrogen fixation: Nitrogenase, Nodulation genes, Genetic engineering of Nitrogenase gene cluster. Host nodulating organisms, in virulence and avirulence, Gene for gene interactions: (Gene-for-gene interactions pathogen interactions in plant resistance).Pathogenicity islands and protein secretion systems: Plant resistance genes(Modulation/Induction)

Unit III:

occurrence, classification based on isoprene rule, Alkaloids: Introduction, Introduction, Terpenes: classification based on nitrogen heterocyclic ring. Steroids: Occurrence, basic structure occurrence, and biological functions of major plant and fungal steroids. Phenolics: Occurrence, basic skhimic acid humans. metabolites to secondary of Importance types, phenolic . pathway,

Unit IV:

Plant pigments: Introduction, biological functions of naturally occurring pigments in plants, Plantinsect interactions: Theory of co-evolution; (Antixenosis, Antobiosis, Tolerance) utilization of toxicantagonisms): pollination, Plant-vertebrate interactions (mutualisms, aminoacids; protein non Fruits, Seed (Dispersal), Plant-plant interactions: Allelopathy

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Dr. Manzier, A.M.

3 – Year Integrated Ph.D. Programme in Chemistry

Paper-I

Title: Research Methodology

Max Marks: 100 Duration: 6 months

Unit – I Spectroscopic Techniques

Molecular Fluorescence Spectroscopy:

Theory: Resonance Fluorescence, single/triplet excited states, Jablonoski diagrams, spectra.

Deactivation processes:Vibrational relaxation, intersystem crossing, internal conversion, fluorescence and phosphorescence, Quantum yield, effect of temperature, solvents and pH on fluorescence.

Instrumentation:Fluorometer and spectrofluorometer, phosphorimeter, light sources filters and monochrometers, detectors, cells and cell compartment.

Atomic absorption spectroscopy:

Theory: Atomic absorption, spectra, atomic line width, sample atomization, continuous atomizers, discrete atomizers, Flame atomization, types of flames, flame structure, common fuels and oxidants. Laminar flow burners, fuel and oxidant regulators, electro thermal atomizers (graphane furnace).

Instrumentation: Radiation sources, Hollow cathode lamp, electrodeless discharge lamps, single and double beam spectrophotometers, spectral interferences, Methods for correcting matrix interferences and chemical interferences.

Unit-II Separation and Electroanalytical Techniques

Separation Techniques :

Introduction to Separation Techniques Introduction to sample pre treatment.

Sample Preparation: Grinding, homogenization and drying of the sample. Dissolution and digestion of insoluble species. General theory of separation efficiency.

Classification of separation techniques: Separation based on size, mass or density, complexation, Change of state and partitioning between phases.

Chromatographic Techniques Gas Chromatography, Liquid Chromatography and High Performance liquid Chromatography. Ion Exchange Chromatography. Classical and High performance techniques. Size Exclusion Chromatography, Super Critical Fluid Chromatography. Affinity and Chiral Chromatographic Techniques.

Coupling of Chromatographic and Spectroscopic techniques: GC-MS, GCFTIR, LC-MS and LC-NMR. Classical Electrophoresis, Gel and Capillary Electrophoresis: Introduction classical electrophoresis : Factors affecting ion migration. Principle and application of gel and capillary electrophoresis. Introduction and application of high performance capillary electrophoresis and capillary electrophoresis.

Field Flow Fraction (FFF): Principles of separation, sub-techniques and application of FFF.

Electrochemical Techniques:

Potentiometry: Principles, Instrumentation . Indicator and reference electrodes, glass pH electrode and Ion-selective electrodes. Applications of Potentiometry.

Coulometric methods: Controlled potential coulometry and coulometric titrations, Principles, Instrumentation and applications.

Amperometric titrations: Basic and applications, Amperometric sensors

Voltammetry; Principles of Linear sweep voltammetry and cyclic voltammetry, stripping methods. Voltammetric instruments and Voltammetric electrodes. Applications.

Polarography: Basics: diffusion current, half-wave potential, Ilkovic equation, DME. (Applications in organic/inorganic analysis)

Unit – III Thermal Techniques and Rheology Thermal Techniques

Thermogravimetry (TG/TGA), Differential Thermal analysis (DTA), Differential scanning calorimetry (DSC) and Thermometric titrations. Basic and instrumentation and applications. Rheology:

Introduction to Rheology and rheometry. Definition of terms. Shear stress, shear rate, viscosity(shear viscosity and Kinematics viscosity), deformation and strain, shear modules.

Viscoelasticity: flow behavior and flow curves viz Newtonian, shear thinning and shear thickening. Model functions for flow curves. Effectof rheological additives in aqueous dispersions. Rheological behavior of surfactants and polymer systems

Unit – IV Literature survey, Date Analysis and Research Ethics:

Literature survey:

Use of Google, Scifinder, Scopus and Pubmed for searching the literature

Date Analysis and Data Analysis Software

Accuracy and precision. Significant figures. Rounding off. Determination of errors. Indeterminate errors. Mean, Median, range, variance and standard deviation. Propagation of errors. Reliability of results. Types of probability distribution: Normal distribution and Binomial distribution. The confidence limit. Tests of significances; the Q test, t- test, F-test. Correlation and regression. Least squares fitting: linear and nonlinear.

Introduction to origin and Microsoft excel: Graphing, statistics and fitting in origin & excel.

Research Ethics:

Scientific conduct: ethics with respect to science and research, intellectual honesty & research integrity: scientific misconducts and misrepresentation of research data.

Publication Ethics: Best Practices, conflict of interest; publication misconduct (Fabrication, Falsification and Plagiarism), authorship and contribution acknowledgement, Hybrid mode of publication. Conflict of interest, complaints and appeals.

Open access: Predatory publishers & journals, UGC Regulations-meaning & concept.

Recommended Books:

- 1. Principles of Instrumental Analysis, 4th Edition, D.A. Skoog, J.J. Leary, Saunders College Publishing
- 2. Modern Analytical Chemistry, 1st Edition, David Harvey, Mc Graw Hill Education, 2000
- 3. Analytical chemistry, 5thEdn. G.D. Christian; John Wiley 2001
- 4. Fundamentals of Analytical Chemistry, 8thEdn. D.A. Skoog, D.M. West, F.J. Holler, S.R. Crouch, Thomson Learning Inc.
- 5. Principles and practices of Analytical Chemistry, 5thEdn. F. W. Fifield, D. Kealey, Blackwell Sciences
- 6. Analytical Chemistry, 2ndedn., R. Kellner, J.M. Mermet, M. Otto, M. Valcarcel and H.M. Widmur; Wiley, 2004.
- 7. Modern Chemical Techniques; C.B. Faust, RSC, 1998
- **8.** Thomas G.Mezger. The Rheology Handbook, 3rd edition, Vincentz Networks 2011. Verlag GmbH & Co. Germany.
- 9. Rheology for Chemists: An introduction, J. Goodwin, R. Hughes, Ed-2, RSC Publishing, 2008.
- **10.** Willard, Merit and Dean, "Instrumental methods of Analysis", John Wiley and Sons, New York.
- 11. Skoog and West, "Fundamentals of Analytical Chemistry", John Wiley and Sons, New York, 1994.
- 12. Jeffery, Basset, Mendham & Denny, "Vogels Text Book of Quantative Analysis", ELBS, 1989.
- 13. Alexender Findley, "Practical Physical Chemistry", revised by B.P. Levitt, Longman, London, 1973
- 14. Shoemaker, Garland &Niber, "Experiments in Physical Chemistry", McGraw-Hill Book Company, 1998.
- 15. Automated Date Analysis Using Excel, Brain D. Bissett, Chapman and Hall/CRC, 2007.
- 16. Origin 2015: Graphing and Analysis from <u>www.originlab.com</u>, An interactive booklet.
- **17.** Practical Skills in Chemistry, J. R. Fean, A.M. Jones, D. Holmes, R. Reed, J. Weyers and A Jones, Pearson Education Ltd., Prentice Hall, 2002.
- **18.** Philosophy of Science by Alexander Bird (1998) Routledge, Taylor & Francis ISBN 9781857285048.
- **19.** 2. Ethics in Competitive Research: Do not get Scooped; do not get plagiarized by Praveen Chaddah (2018) ISBN 9387480860
- **20.** 3. National Academy of Sciences, National Academy of Engineering and Institute of Medicine (2009)., National On being a Scientist: A guide to responsible conduct in Research : third edition, National Academies Press.

3 – YearIntegrated Ph.D. Programme in Chemistry

Paper-II

Title: Recent Trends in Chemistry

Max Marks: 100 Duration:6 months

Unit – I Green & Sustainable Chemistry Green Chemistry-

Introduction: Need for Green Chemistry and the role of chemists.

Principles of Green Chemistry. Tools of Green Chemistry: Selection of starting materials, Catalysts, Alternative Solvents, Appropriate reagents, Percentage atom utilization. Microwaves and Sonication.

Green Chemistry-Practice: Green Solvents and Reaction conditions: Supracritical fluids, Aqueous reaction conditions, Immobilized Solvents and irradiative reaction conditions. Examples of Green materials, reagents and some specific reactions

Unit – II Homo & Heterogeneous Catalysis using Organometallics

Introduction, History and Importance of Organometallic Compounds as reagents, additives and Catalysis

Mechanism of Catalysis using Organometallics:- Oxidative addition, insertion reactions, Reductive elimination and Water gas Shift reaction (WGSR)

Catalytic Mechanism of Hydrogenation, Hydroformulation, oxidative and isomerization of alkenes, Olefin metathesis

Fischer-Tropsch Synthesis and Zeigler Natta Polymerization of alkenes

Unit – III Chemistry of Materials

Liquid Crystals: Mesomorphism, types of liquid crystals, properties of liquids crystals, Characterization by optical polarization microscopy, Applications – Liquid crystal displays, thermography, optical imaging and ferroelectric liquid crystals

Langmuir – Blodgett Films: Introduction and general preparative techniques. LB Films of various compounds (hydrocarbon, liquid crystals compounds and polymers), Applications – nonlinear optical effects, conduction, photoconductivity and sensors.

Block Copolymers: Introduction: Classification, micellization of diblock and triblock copolymers. Introduction to PH-, thermo- and Photo-responsive block copolymers. Linear-dendrimer block copolymers: introduction, structural peculiarities of their aggregates, potential applications

Unit – IV Novel Materials

Bio-inspired smart materials: Introduction to bio-inspired materials. Examples and applications of following bio-inspired materials: bioceramics, bioglasses, self-healing, PH-responsive, photo-responsive, stress-responsive and electric-responsive materials.

Nanomaterials: Introduction with examples and applications of nanoparticles, nanofibers (nanowires, nanotubes and nanorods) and nanoplates.

Graphene: Introduction. Overview of electrochemistry of grapheme. Graphene based electrochemical sensors for enzymes, DNA and heavy metals

Recommended Books:

- 1. Green Chemistry An introduction Text; IIndEdn. ; Mike Lancaster; RSC; 2010.
- 2. Green Chemistry- Theory and Practice; P. T. Anastas and J.C. Warner; Oxford ; 2000.
- 3. Inorganic Chemistry; 4thedn.; Huheey; E. Keiter; Addison- Wesley; 1983
- 4. Metallo-Organic Chemistry; A.J. Pearson; Wiley.
- 5. Fundamental Transition Metal Organometallic Chemistry; Luke hart; Books / Cole; 1985
- **6.** The Physics and Chemistry of materials, J.I. Gersten, F.W. Smith, John Wiley and Sons, Inc. 2001.
- 7. Smart Materials. M. Schwartz, CRC Press, 2008.
- 8. Thermotropic Liquid Crystals, Ed., G.W. Gray, John Wiley
- **9.** Blcok Copolymers, N. Hadijichristidis, S. Pispas and G.A. Floudas , Wiley, New York, 2003.
- 10. The Physics of Block Copolymers, I. W. Hamley, Oxford University Press, Oxford, 1998
- 11. P. Alexandridis and J.F. Holzwarth, Curr. Opin Colloid Interface Sci. 5, 312, 2000.
- **12.** Green Chemistry Environment Friendly Alternatives; Rashmi Sangh & M.M. Srivastava; Narosa ; 2007.
- **13.** Nanotechnology, An introduction, J.J. Ramsden, Elsevier, 1st Edition, 2011.
- 14. Essentials of Nanotechnology, J.J. Ramsden, Jeremy Ramsden and Ventus Publishing Aps, 2009

3 – Year Integrated Ph.D. Programme in Chemistry (Supervisor Specific Specialized Papers)

Course No.: 03

Title: Specialized Paper

Max Marks: 100

Duration :6 months

Unit I: Oscillatory Chemical reactions

Introduction: History; Fundamentals; Apparatus: Analytical techniques- Spectroscopic methods; Potentiometric methods. Batch reactors, Semi batch reactors; Flow reactors; Pumps; Reactor for Chemical waves.

Types of Oscillatory Chemical reactions- Belousov-Zhabotinsky reaction; FKN mechanism; Effect of Substrate; metal ion; acid; additives (alcohol, Surfactants, ketones, etc). Briggs-Rauscher reaction; Bray-Liebhafsky reaction; Chlorite-Iodate oscillator; pH Oscillators.

Unit II: Patterns, Waves and Chaos

Stability analysis; Arsenous acid-Iodate reaction; Propagator-Controller systems; Wave initiation; Waves in two dimensions- Target patterns and Spirals; Three dimensional waves; Chemical waves and patterns in open systems; Chemical waves in Non-uniform media;

Complex oscillations; Mixed mode oscillations; chemical chaos; One dimensional maps; characterising chaos; controlling chaos. Stirring and Mixing Effects.

Unit III: Polymer Systems

Introduction: Sources of feedback; Thermal Oscillations; Emulsion polymerisation; Radical polymerisation; Biopolymers; Synthetic polymers; Frontal polymerization-Mechanism.

Polymerization coupled to Oscillatory reactions; Ordering phenomena in Phase separation of Polymer mixture; Photo-Crosslinking of Ploymer blends; Coupled Oscillators; Oscillator death; Biorhythmicity; Compound Oscillation.

Unit IV: Applications of Nonlinear Chemical Dynamics

Biological Oscillators: Neural Oscillators-Burstimg; Microtubule polymerization; Synthesis of polymers using oscillatory reactions; Analytical monitoring of various chemical entities viz. antioxidants, metals, drugs, etc. Ion exchangers : Role of Ion exchangers in changing oscillatory parameters; Pattern formation using ion exchangers; Corrosion chemistry: Synthesis of corrosion inhibition polymers using oscillatory reactions; Turing patterns; Future directions.

BooksRecommended:

- 1. An Intorduction to Nonlinear Chemical Dynamics- Oscillations, waves, patterns and chaos; J. A. Pojman and M. Burger, 1998
- 2. Chemical Waves and Patterns, Raymond Kapral and Kenneth Showalter, Springer, 2012.
- **3.** Oscillations and Travelling waves in Chemical Systems, M. Burger and R. J. Field, Wiley Interscience, 1985.
- **4.** Nonlinear Dynamics with Polymers, Fundamentals, Methods and Aplications, edited by John A. Pojman and Qui Tran-Cong-Miyata, Wiley-VCH, 2010

3 – Year Integrated Ph.D. Programme in Chemistry

Course No.: 03

Title: Specialized Paper

Unit 1. Liquids and Solutions

Viscosity, Newtonian and non-Newtonian behavior, Stokes–Navier equation, Einstein's law of viscosity, intrinsic viscosity and particle size, viscometers. Light scattering by colloidal solutions, aggregation number by light scattering and florescence spectral methods. Isothermal and adiabatic compressibility of liquids and solutions.

Non-ideal solutions: Virial equation of state, second virial coefficient as a measure of nonideality, excluded volume. Regular solution and Flory- Huggins statistical theory with their application to binary liquid mixtures. DLVO- theory for stability of colloids.

Unit 2. Micelles and Microemulsions

Micellization of surfactants, critical micelle concentration (cmc), structure and shape of micelles, aggregation number. Factors affecting cmc in aqueous media and their role in micellization. Equations for cmc based on theoretical grounds. Thermodynamics of micellization, pseudophase model and mass action model, self-assembly.

Macroemulsions, Microemulsions and Nanoemulsions: formation and stability. Structuredynamics and transport properties of microemulsions. Applications of microemulsions in food, textile, agro-chemical, pharmaceutical and petroleum industries with focus on their role in environmental remediation, biotechnology and chemical reactions.

Unit3. Importance of Micelles and microemulsions in growing Technological Advancements.

Micellar Solubilization: Experimental methods of studying solubilization and factors affecting it. Solubilization of drugs into micelles and its importance. Effect of surfactants on membrane permeability with respect to drugs. Drug delivery systems and controlled release.

Reactivity in surfactant systems: Micellar reactions; hydrolysis, oxidation, reduction, luminescence and fluorescence, reactions involving metal ions, enzyme catalyzed reactions and oscillatory reactions.

Unit 4. Surfactant-Surfactantand surfactant-polymer interactions

Surfactant-Surfactant Interactions:Mixed micelle formation, mixed monolayer formation, synergism, various models of mixed micelle formation(Clint, Rubingh, Motamurra, Blankschtein, and Rubing-Holland models) and mixed monolayer formation(Rosen's model). Importance and practical applications of mixed surfactant systems.

Surfactant-PolymerInteractions: Effect of polymers on aggregation behavior of surfactants and the factors governing their interaction . Phase behavior of polymer-surfactant mixtures. Characterization of polymer- surfactant systems by various techniques like viscosity, light scattering, spectroscopic and conductance measurements.

Max Marks: 100

Duration :6 months

Books recommended

- 1. J.N. Murell and E. H. Boucher, "Properties of Liquids and Solutions," John wiley& Sons Ltd., 1982
- 2. P.W. Atkins. "Physical Chemistry", ELBS, Oxford, 1994.
- **3.** P.C. Heimenz, "Principles of Colloid and Surface Chemistry", Marcel Dekker Inc. New York, 1986.
- 4. M. J. Rosen, "Surfactants and Interfacial Phenomena", John Wiley & Sons, New York, 1989.
- 5. R. D. Vold and M. J. Vold, "Colloid and Interface Chemistry", Addison-wesley, 1982.
- 6. .D. Y. Meyer, "Surfaces, Interfaces and Colloid", VCH Publishers, Inc. 1991.
- 7. Jonsson, Lindmann, Homberg and Kronberg, "Surfactants and polymers in aqueous solution", John Wiley and sons, 1998
- 8. B.K.Paul&S.P.Moulik, *Current Science*, Vol.80, p 990-, 2001; *Advances in Colloid and Polymer Science*, Vol.78, p 99, 1998
- **9.** John Flanagan & Harjinder Singh, *Critical Reviews in Food Science and Nutrition*, Vol.46, pp221-237, 2006.
- 10. M.J.Lawrence&G.D.Rees, Advanced Drug Delivery Reviews, Vol, 45, p 898, 2000.
- 11. T.N.Dantas, A.A.D, Netoetal., Energy Fuels, DOI:10.1021/ef900952y, 2010.

3 – Year Integrated Ph.D. Programme in Chemistry

Course No. : 03 Title: Specialization Paper Max Marks: 100 Duration :3 hours

Unit-I: Foundations of Molecular Orbital Theory:

Quantum mechanics and the wave function. The Hamiltonian Operator; General features, the Variational Principle, the Born-Oppenheimer Approximation. Construction of trial wave functions; the LCAO basis set approach, the secular equation. Huckel theory; fundamental principles, application to the Allyl systems. Many –electron wave functions; Hartree-product wave functions, the Hartree Hamiltonian, electron spin and antisymmetry, Slater determinants, the Hartree-Fock Self-consistent Field Method.

Unit-II: Ab Initio Implementation of Hartree-Fock Molecular Orbital Theory:

Basis sets; Functional forms, contracted Gaussian functions, Single- ζ , Multiple- ζ , and Split- Valence, polarization functions, diffuse functions, the HF limit, effective core potentials, Technical aspects; SCF convergence, symmetry, open shell systems, efficiency of implementation and Use.

Unit-III: Writing in LaTeX

LaTeX: Basics, LaTeX input files, Document classes, Page styles, Packages, Commonly used LaTeX commands, Typesetting text and mathematical formulae, Constructing tables, Producing mathematical graphics using the picture environment, Using graphics in LaTeX, The Figure environment, Creating presentations with LaTeX classes.

UNIT – IV: Working with Gaussian

Resource management; % mem, %rwf, %chk, % nproc. Number of processors for different methods. Route card description syntax. Creation of input files; single point energy and properties, geometry optimization, frequency, reaction path following /searching. Levels of theory; Molecular Mechanics, Semi-empirical, Density Functional theory, Ab-initio, Hybrid etc. Basis set. Basis set types- all electron: Pople, Dunning,Huzinaga etc.; effective core potential. Molecular coordinates; Cartesian co-ordinates; Z-matrix. Building with Gauss View; remote login, loading of proper module, launching of GaussView. Syntax for submitting calculations; Interactive, Batch and Queue commands. Common errors; memory errors, disc errors, SCF failure, Coupled cluster iteration failure, optimization failure. Output visualization and interpretation of output files.

Books recommended:

- **1.** Computational Chemistry, A Practical Guide For Applying Techniques to Real World Problems: David Young: Wiley-Interscience:2001
- 2. Electronic Structure; Basic theory and practical methods: Richard M. Martin: Cambridge University Press:2004
- **3.** Exploring Chemistry with Electronic Structure Methods: 2nd ed. James B. Foresman and Aeleen Frisch: Gaussian, Inc. 1996.
- **4.** LaTeX by Leslie Lamport published by PEARSON Education (2004).

3 – Year Integrated Ph.D. Programme in Chemistry

Course No. : 03 Title: Specialized Paper Max Marks: 100 Duration: 3 hours

Unit I: Ion – Exchange Materials:

Introduction: Historical development of ion –exchange materials. Basic types of ion-exchangers, miscellaneous exchangers. The Zeolites : Molecular sieve properties of the zeolites. Zeolites as ionic sieves. Selectively in zeolite series. The Linda molecular sieves – double sieve action. Exchange isotherms in the zeolites. Hydrous oxides and Salts of Polybasic Metals: The hydrous oxides. Quadrivalent metal oxides. Insoluble salts of polybasic metals; Zirconium phosphate. Preparation of zirconium phosphate. Physical and chemical properties of zirconium phosphate. Intercalation and pillaring in zirconium phosphate. Ion exchange in Zirconium phosphate. Selectively in Zirconium phosphate. Ion-sieve properties of zirconium phosphate.

Unit II:

(A) Ion-Exchange Kinetics:

Ion-Exchange Kinetics: Systems, Mechanism, and the Rate Controlling Step. Diffusion in Ion-Exchangers. Rate of Ion Exchange: Partial-diffusion control; Film diffusion control; Intermediate cases. Ion exchange accompanied by neutralization, complex formation, or other reactions. Multicomponent systems. Simplified rate equations.

(B)Ion – Exchange Selectively:

Introduction: General qualitative description of the selectively phenomenon. Quantitative definition of selectively; exchange; exchange involving monovalent ions only; Excahnge involving multivalent ions. Experimentally observed features in Uni-Univalent Exchange. Approaches to the understanding of Ion –exchange Selectively. Factors underlying ion-exchange selectively; Non uniformity of exchange sites; Ion-water interactions; Ion – ion interactions. The effect of swelling.

UNIT-III:Low Temperature Synthetic Routes:

Co-precipitation, Sonochemical, Microemulsion; Solution combustion, Sol-gel.

Sol-gel: hydrolytic sol-gel, non-hydrolytic sol-gel, acid reflux, acid digestion, and mild hydrothermal or autoclave methods. Detailed mechanism of synthesis, Comparison. Advantages and disadvantages of different synthetic methods

Unit IV: Characterization techniques:

UV-Vis spectra: Beer's law. Limitation to Beer's law, Quantitative analysis: Calibration curve method, standard addition method, Quantitative analysis of mixtures.**Instrumentation**: Light sources, wavelength selectors (dispersion devices), sample containers, Detectors, Signal processor and read-out. Filter photometers, construction and working of Single beam, double beam and split beam spectrophotometers.

X-Ray Diffraction (XRD), Powder X-Ray Diffraction, Scanning Electron microscopy (SEM) and Transmission Electron Microscopy (TEM) : Principles and applications

Thermal Analysis: Differential Scanning Calorimetry (DSC), Calorimetry, Thermal Gravimetric Analysis (TGA), and Differential Thermal Analysis (DTA): Principle and applications

Books Recommended:-

- 1. Ion Exchange-A series of Advances: Vol. 1. Jacob A. Marinsky: Marcel Dekker: 1969
- 2. Ion Exchange-A series of Advances: Vol. 2. Jacob A. Marinsky: Marcel Dekker: 1969
- 3. Inorganic Ion Exchangers: C. B. Amphlett: Elsevier: 1969
- **4.** Ion Exchange: Dmitri Muraviev, Vladimir Gorshkov and Abraham Warshawsky: Marcel Dekker: 2000
- Introductory Raman Spectroscopy: 2nd ed. John R. Ferraro, Kazuo Nakamoto and Chris W. Brown: Academic Press: 2005
- 6. Modern Analytical Chemistry: David Harvey: Mc Graw Hill: 2000).
- 7. Infrared and Raman Spectra of Inorganic and Co-ordination Compounds: 5th ed. Kazue Nakamoto: John Wiley: 1997
- **8.** Principles of Instrumental Analysis: 4th ed. Douglas A. Skoog and James J. Leary: Saunders: 1992

3 – Year Integrated Ph.D. Programme in Chemistry

Course No. : 03 Title: Specialized Paper Max Marks: 100 Duration :3 hours

UNIT 1: Organic Solvents and Reagents:

Purification, drying and handling of the following common organic solvents and reagents:

DMSO, DMF, Pyridine, Ethyl Alcohol, Petroleum ether, Methanol, Ethyl acetate, Chloroform, Benzene and Methylene chloride.

Preparation and uses of following reagents:

Alkyl and Aryl lithium compounds, Aluminiumisopropoxide, Diazomethane, Raney nickel, Libberman-Burchard reagent, Tortelli reagent, Fieser reagent, Salkowski reagent, Dragendroff's reagent, Cerric ammonium sulphate.

UNIT II: Spectroscopy

- a) **Problem based exercises on interpretation of spectral data using** UV-IR H¹NMR,C13NMR and Mass
- b) Applications of advanced NMR techniques: DEPT, COSY, 2DNMR
- c) **ORD/CD:** Circular birefringence, ORD and CD Curves, relationship between ORD and CD and their applications. Distant rule. Displacement rule, rule of super position. Axial haloketone rule, Octant rule and its applications to ketos steroids.

UNIT III :Designing organic synthesis / Named reactions

Designing synthesis of following compounds using retrosynthetic approach.

ICI-DD7114,Oformine, Phenylramidol, propanolol, Pre-moth-pheromone, Arildone,Cinflumide, Venlafaxine,Clobutinol,Thyroxine and salbutamol.

Named reaction

Arndt-Eisterthomologation, Bartoli Indole synthesis, Beckmann Rearrangement, Cope elemintion, Barton- Zard reaction for the synthesis of pyrolles, Corey Chaykovsky reaction,

Corey Kim Oxidation, De-Mayo reaction, Dienone-Phenol rearrangement, Henery Notro aldol reaction, Jones Oxidation, wittigrearrangement, Pechmann coumarin synthesis, Nef reaction.

UNIT IV : ALKALOIDS

Naming of Alkaloids, Classification, Properties, Distribution in nature.Biosynthesis of alkaloids, Qualitative tests, Chemical and Spectral methods of Structural elucidation.

β-carboline Alkaloids: Structure, Examples, Occurrence in nature, Pharmacology, Synthesis. **Applications:**

Alkaloids in modern medicine, Alkaloids as drug leads.

Recommended Books:

- 1) Organic Chemistry- Finar Vol:II, ELBS-Longman 1975.
- 2) Organic Chemistry- Clayden, Greeves and Warren, Oxford UniversityPress, 2001.
- 3) Organic Spectroscopy- Kamp, Macmillan and ETBC, 1995.
- 4) Mass Spectroscopy- Davis and Freavson, Jhon Wiley.
- 5) Spectroscopic Identification of organic compounds, 5th edition; Silverstein, Bassler, John Wiley, 1991.
- 6) Reagents for Organic Synthesis, M.Fieser and L.F. Fieser 1974.
- 7) Spectroscopic Methods in Organic Chemistry, 4thEddition D.H. Williams and Ian Fleming, Jhon Wiley, 1998.

DEPARTMENT OF CLINICAL BIOCHEMISTRY, UNIVERSITY OF KASHMIR SYLLABUS FOR INTEGRATED PH. D PROGRAM COURSE WORK

Paper, I Research Methodology (CLB IPHD-01)

Unit I - Research design and types

Purpose and motivation in research, Importance of bibliography and Review of literature in research. Types of information sources – primary and secondary sources, Identifying research gaps/areas from literature review. Selection and identification of the research problem. Design and identification of principle objectives, hypothesis and aim of research. Criterion of a good research proposal. Research methods used in social settings- including experimental, quasi- experimental and qualitative methods. Elements of reliable and valid research, reduction of bias research.

Unit II - Research Ethics

Definition and Objectives of research ethics, academic honesty, types of ethical issues in research, codes and policies for research ethics, criteria and principles for good research practice, Scientific misconducts – Falsification, Fabrication and Plagiarism, Plagiarism policies & types - penalties and consequences, detection of plagiarism by using different online tools, Publication ethics-definition and importance, conflicts of interest; publication misconduct – definition, concept and problems leading to unenthical behavior, Violation of publication ethics, authorship and contributorship; procedures and ethical principles of guiding research, guidelines for the ethical conduct in the animal use and welfare, ethical issues in methodology of clinical research, laboratory safety and management of laboratory wastes.

Unit III- Statistics in research

Significance of statistics in biological research, Concepts of data, Tools for data collection, Pilot Studies and Pre-tests, Statistical approaches and significance- Probability, Binomial distribution, Poisson distribution, Normal distribution, Regression and Correlation Analysis, Test of Significance- Chi-Square test, T-test and F-test, Sampling Techniques or Methods- Choice of Sampling Techniques, Sample Size, Sampling and Non-Sampling Errors, Correlation and regression analysis, Knowledge of ANOVA, SPSS and STATA soft wares and their applications.

Unit IV- Techniques employed in Clinical Biochemistry

Techniques for DNA and RNA isolation, Gene cloning, screening and selection of recombinant clones, RFLP, RAPD analysis, PCR and its types, Site directed mutagenesis, Electrophoresis - Agarose and PAGE, Isoelectric focusing, Blotting techniques (Western,Northern and Southern blotting), PCR and its types, ELISA and its types, Microscopy – preparation and processing of samples, Types of microscopy-Compound microscope, Electron microscope and Fluorescence Microscope)

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Paper II Advances in Clinical Biochemistry (CLB IPHD-02)

Unit-I- Molecular Diagnostics

Introduction - Reverse transcriptase PCR, Quantitative real time PCR, the basic concept and threshold cycle, fluorescent dyes used in real time PCR, TaqmanTM, specimen collection and transportation, nucleic acids extraction, PCR optimization and inhibitors, handling contamination, applications of real time PCR as diagnostic tool. Chip based diagnostics - DNA sequence analysis, gene expression profiling, biomarker detection, their role in detection of diseases or their susceptibility, applications of chips; Molecular diagnostics of non-infectious diseases such as diabetes, metabolic syndrome, Alzheimer's and molecular markers for early detection of cancer.

Unit II- Automation in Clinical Biochemistry

Types of Automation, Individual steps in the analytical processes, Reagent handling and storage, reagent delivery, Chemical reaction phase, Development of standards for laboratory automation. Other areas of automation; urine analyzers, hematology cell counters and flow-cytometers. Quality Assurance & Management: Fundamentals of total quality management, elements of quality assurance program. External quality assessment- Identifying the source of analytical errors. Fundamentals of Lab Safety. Establishment and use of reference values: Concept of reference values, Selection of reference individuals, Specimen collection, Analytical procedures and quality control. Methods for determining the reference values and presentation of an observed value in relation to reference value.

Unit III Laboratory diagnostics

Blood routine examination- RBC, HGB, WBC, WBC differential count reference values and clinical significance, Differential blood cells count, significance of dysmorphic blood cells, Blood routine examination (HCT, ESR, Ret), Laboratory diagnosis of anemia, tests of anemia, the significance of relevant parameters of hematology analyzers. Lipid metabolism disorders and diseases, Changes of blood glucose in hepatic disease, Common renal function tests and their clinical significance, Clinical application of blood gas analysis and acid-base balance tests, Serum K+, Na+, Cl- tests and their clinical significance.

Unit IV Bioinformatics

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Role of Bioinformatics - in clinical research, drug development and vaccine development, Gene Bank, Nucleotide sequence databank, DNA data bank of Japan, protein data bases-Primary and secondary data bases, database formats, structural data bases, protein data bases, Molecular model bank, protein- protein interaction detection tools and data bases, Tools for primer designs, Citation management tools.

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Ph.D. Course Work

Paper I: Research Methodology

Max Marks: 100

<u>UNIT I:</u>

Research: Meaning, Objective, Type of research. Criteria of good research. Research Approaches.

Research Process: Problem Definition, Literature survey, Hypothesis Formulation, Research design, data collection, data analysis, Interpretation, Report writing.

UNIT II:

Research design: Meaning, Features and need

Data Collection: Collection of primary data, Schedules; Collection of secondary data; Published and unpublished.

Academic databases: Academic databases for Computer Science discipline.

UNIT III:

Literature Collection: Sources of literature collection. Collection of relevant literature. **Review of Literature:** Critical Review of Collected Literature. Identifying strong and weak features of existing methodologies/techniques.

UNIT IV:

Report Writing: Skills of writing advanced technical papers.

Presentation: Skills of presenting advanced technical concepts easily.

Ethics in Research: APA Ethics Code, Intellectual property rights, Patent law. Plagiarism – Definition, Various forms, and Avoidance (practices and tools).

References:

- 1. "Research Methodolpgy" C. R. Kothari,
- 2. *"Research design: Qualitative, Quantitative, and mixed method approaches",* John W. Creswell, Sage Publications, 2014.
- 3. "Research methodology: Methods & Techniques", C.R. Kothari, New Age International Publishers, 2004.
- 4. *"Research methods for everyday life: Blending qualitative & quantitative approaches"*, Scott W. Vanderstoep & Deirdre D. Johnston, Wiley, 2009.
- 5. *"Research Imagination: An introduction to qualitative & quantitative methods",* Paul S. Gray, John B. Williamson, David A. Karp, John R. Dalphin, Cambridge University Press, 2007.
- 6. "Writing for Computer Science", Justin Zobel, Springer-Verilag, 2014.
- 7. "Writing your thesis", Paul Oliver, Sage Publication, 2004.
- 8. "Ethics in Research", Ian Gregory, Continuum Research Methods Series, Continuum, 2003.

Paper II: Recent Advances in Computer Science

<u>UNIT – I</u>

Big Data: Definition and Explanation. Characteristics of Big Data (Basic, 3V and 5V). Types of Big Data – Structured, Semi-structured, and unstructured. Why Big Data is important? **Big Data Technology Foundation:** Physical Infrastructure (Generation, Computation, Communication, and Storage), Security Infrastructure. Current trends and Challenges.

<u>UNIT – II</u>

Cloud Computing: Overview, Evolution and Characteristics. How Cloud Computing works? Pros and Cons of Cloud Computing. Challenges of Cloud Computing. Comparison with traditional computing architecture (Client/Server). Comparison with other recent computing trends (Grid, Cluster and Distributed Computing).

Virtualization: Introduction to virtualization, types and implementation levels.

Cloud Computing Architecture: Cloud computing stack, *Introduction to Cloud Service Models* - Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). *Introduction to Cloud Deployment Models* – Public Cloud, Private Cloud, Hybrid Cloud, and Community Cloud. Services provided at various levels.

<u>UNIT – III</u>

IoT Definition: Overview, Application, Potential and Challenges, Architecture, M2M vs IoT. **Internet vs IoT:** Layers, Protocols, Packet-services, Performance parameters of Packet-networks (Web, P2P, Sensor Networks, & Multimedia).

References:

"Big Data for Dummies", Judith Hurwith, Alan Nugent, Fern Halper, and Marcia Kaufman, John Wiley & Sons, 2013.

"Big Data – Principles and best practices of scalable real-time data systems", Nathan Marz and James Warren, Dreamtech Press, 2016.

"Cloud Computing Bible", Barrie Sosinsky, Wiley-India, 2010.

"Cloud Computing: Principles and Paradigms", Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011.

"Designing Internet-of-Things", Adrain McEwen, & Hakim Cassimally, Wiley.

"The Internet of Things", Samuel Greengard, MIT Press.

"The Silent Intelligence: The Internet of Things", Daniel Kellmereit & Daniel Obodovksi, DND Ventures LLC.

"Internet of Things: A hands on approach", Arhdeep Bahga, & Vijay Madisetti, Orient Blackswan.

Department of English

Syllabus for Integrated Ph D Programme w.e.f October, 2023

Paper I: Recent Advances in the Subject

Unit I: Postmodernism

- The origins of Postmodernism
- Postmodern Theories and Frameworks:Barthes, Lyotard, Baudrillard
- Understanding Postmodern Literature

Literary text Don Delillo: *White Noise*

Unit II:Postcolonialism

- Colonization, Decolonization and Postcolonialism
- Postcolonial Identities
- Themes and issues in Postcolonial literatures

Aravind Adiga: The White Tiger

Unit III: Gender Studies

- Understanding Gender
- Identity and Sexuality
- Masculinity, Feminity and Alternate Genders
- Feminist theories

Recommended Text:

Lips, Hilary M., 2015, Gender the basics, Routledge, London

Unit IV: Cultural Studies

- Introduction to Cultural Studies
- Subjectivity, Identity and Ideology
- Representation, Power and Discourse
- Popular culture
- Media and Cyberculture

Recommended Text

During, Simon. Cultural Studies: A Critical Introduction.

Paper II: Research Methodology and Critical Perspectives

Unit I

- Introduction to Research, Definition, Research Objectives
- Types of Research: Descriptive vs Analytical Qualitive vs Quantitative Conceptual vs Empirical Research Mixed-method research
- Critical thinking, Techniques for generating research topics. Topic selection and justification
- Ethical and moral issues in Research, Intellectual Property Right, Plagiarism, tools to identify predatory journals

Unit II

- Materials in Research (Primary and Secondary data)
- Literature Review;Use of online tools
- Documentation: Format Styles -Using the MLA format and Citation
- Structuring a thesis: Indentation, Margins, Font, Spacing, Heading and Title, Pagination, Abbreviations, Table of Contents, Headings and Sub-headings, Appendix, Bibliography and Proof Reading

Unit III: Marxist Literary Criticism

Unit IV: New Historicism

Cultural Materialism

Syllabus for Integrated Ph.D Programme in Geography (2020 onwards)

Paper-I: Methodology	Time: 3 Hours	Max. Marks: 100

Unit- I

- 1.1 Research, Scientific Research-Concept & Characteristics, Approach to research
- 1.2 Identification of the Problem, Assessing the status of the Problem
- 1.3 Formulating the objectives, preparing the design, experimental or otherwise
- 1.4 Literature Review and Research Gap

Unit- II

- 2.1 Concept of hypothesis
- 2.2 Hypothesis formulation
- 2.3 Types of hypothesis and Hypothesis Testing
- 2.4 Sampling: Methods and its types

Unit- III

- 3.1 Types of Data: Primary, Secondary & Experimental data
- 3.2 Generation of primary data & its methods- Sampling
- 3.3 Designing of structured questionnaire, Validation of questionnaire, Processing& Analysis of Data.
- 3.4 Report writing- Format, Citations, Design of Chapters, Inferences, Findings and Conclusion, Bibliography & Webliography

Unit- IV

- 4.1 Philosophy and Methodology in Geography, Recent research approaches in Geography
- 4.2 Scientific explanation in geographical research and types of explanations; Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)
- 4.3 **Research Ethics**: Nature and Concept
- 4.4 Concept, meaning & Framework of Models

References:

- Milan .T Mistry (2015). Advanced Educational Research and Statistics, Paradise Publishers, New Delhi.
- Mishra R.P., (2001). Research Methodology, Concept Publishing Company, New Delhi,

- Kothari, C. R. (1985) Research Methodology, Methods and Techniques, New Age International Publishers.
- R.B. Singh (1996) Research in Geography, Disasters and Environment, APH Publishers, New Delhi.
- > Mayer P.L., Introductory Probability and Statistical Application
- Shashi Shelihar & Sanjay Chawla, Spatial Databases: A tour, Prentice Hall.
- Andres, A.C. (1987) : The Analogy Theme in Geography; Journal of Geography 86 (55) : 194-197 2.
- Campbell, D.T. eds. And Overman, E.S.(1988): Methodology and Epistemology for Social Science: Chicago: The University of Chicago Press
- ➤ Fowler, F.J. (1995) : Improving Survey Questions; Thousand Oaks : Sage
- Gomez, B and J Jones III J.P. eds. (2010) : Research Methods in Geography: A critical Introduction; West Sussex : Wiley-Blackwell 4
- Hay, I. ed. (2000) : Qualitative Research Methods in Human Geography; Oxford : Oxford University Press
- Livingstone, D.N., and Withers, C.W. (2005) : Geography and Revolution; Chicago : The University of Chicago Press
- Valentine, G. and Chifford, N. eds. (2010) : Key Methods in Geography; New Delhi: Sage Publications Pvt. Ltd.

Syllabus for Integrated Ph.D Programme in Geography (2020 onwards)

Paper-II:Recent Advances in the SubjectTime:3 HoursMax. Marks: 100

Unit I

- 1.1. Climate change and its consequences; A Geographical perspective
- 1.2. Natural hazards and Disasters, Framework & Policies International / National /Regional
- 1.3. Land degradation and Land use planning; A Geographical perspective
- 1.4. Food security; National scenario
- 1.5. Geopolitical issues; Emerging boundary issues National & Local, Energy Security

Unit II

- 2.1. Globalization; Problems & Prospects
- 2.2. Carrying Capacity of Physical and Social System; Wetlands and Tourist Nodes
- 2.3. Framework for Environmental Impact Assessment & Environmental Management Plan
- 2.4. Ecological Economics Concept
- 2.5. Smart Cities Concept

Unit III

- 3.1. Global Positioning System (GPS) & its applications
- 3.2. Current trends in GIS: Big data integration
- 3.3. Hyperspectral Remote Sensing
- 3.4. Microwave Remote Sensing
- 3.5. Remote Sensing, GIS & GPS interface & integration

Unit IV

- 4.1. Climatic Modeling GCM
- 4.2. Land use Modeling Markov
- 4.3. Watershed Modeling, Distributed Models SWAT
- 4.5 Health Model Epidemiological Transition Model

References:

- Andrew Skidmore, 2008, Environmental Modelling with GIS and Remote Sensing, Taylor & Francis.
- Barthwal R.R. 2002. Environmental Impact Assessment. New Age International Publisher, 354 p.
- Betty Bowers Marriott, 1997, Environmental Impact Assessment: A Practical Guide, McGraw Hill.
- Lillesand, T.M & Kiefer, R.W, 1987. Remote Sensing and Image Interpretation, John Wiley and Sons Ltd.
- > Open Geospatial Consortium (OGC): http://www.opengeospatial.org/.
- Michael f. Goodchild, 2005, Geographical Information Systems, principles, techniques, management and applications, John Wiley & Sons Inc., 404 p.
- Paul A. Longley, 2010, Geographic Information Systems and Sciences, John Wiley and Sons Ltd, 536 p.
- Schowengerdt, R.A., 2007, Remote Sensing: Models and Methods for Image Processing, Academic Press.
- Common, M.S. and A Stage, S. (2005): Ecological Economics: An Introduction; Cambridge: Cambridge University Press.
- Daly, H. E. ad Farley, J. (2004) : Ecological Economics : Principles and Applications; Washington, D.C.: Island Press
- Heathcote, I.W, (2009): Integrated Watershed Management: Principles and Practice; New Jersey : John Wilsey & Sons Inc.
- Canter, L.W., 1996. Environment Impact Assessment , Mc Graw Hill Inc. New York.
- Hussain,M., 1999, Agricultural Geography, Rawat Publications, Jaipur. 19. Jasbir,S. and Dhillon, S.S., 1988, Agricultural Geography, Tata McGraw Hill, N.
- Peter,A. and Hazen,H. (2011). An Introduction to the Geography of Health, Routledge, New York
- Montello, D.R., and Suttor, P.C. (2006): An Introduction to Scientific Research Methods in Geography; New Delhi : Sage Publications India Pvt. Ltd.,

Department of Management Studies Syllabus for M.Phil/PhD/3Year Integrated PhD Entrance Test 2018 Management (MBA/IMBA/ MBAFM)

Unit-I

Managerial Economics-Demand Analysis, Production Function, Cost-Output Relations, Market Structures, Pricing Theories; National Income concepts; Business environment. 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. Role and Scope of Operations Research; Linear Programming; Transportation Model; Inventory Control; Queueing Theory; Decision Theory; PERT/CPM. Probability Theory; Probability distributions-Binomial, Poisson and Normal; Correlation and Regression analysis; Research process; Research Design; Sampling theory; Sampling distributions; Data Sources, Tests of Hypothesis; Large and small samples; t z, F, Chi-square tests.

Unit-II

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. Concept and significance of organisational behaviour-Skills and Roles in an organisation-Classical, Neo-Classical and Modern Theories of Organisational Structure-Organisational Design-Understanding and Managing individual behaviour personality-Perception-Values-Attitudes-Learning-Motivation. Understanding and Managing Group Behaviour, Processes-Inter-personal and group dynamics-Communication-Leadership-Managing change-Managing conflicts. Organisational Development; Ethical issues and analysis in Management; Value based organisations; Environmental ethics; Social responsibilities of business; Corporate governance; Entrepreneurial characteristics; Motivation and competencies; Innovation and Entrepreneurship; Business Opportunity Identification; Detailed business plan preparation; Intrapreneurship.

Unit-III

Marketing-Concept; Nature and Scope; Marketing mix; Different environments and their influences on marketing; Understanding the customer and competition. Segmentation, Targeting and Positioning; Product Life Cycle; Brands-Meaning and Role; Brand building strategies; Share increasing strategies. Pricing objectives; Pricing concepts; Pricing methods. Product-Basic and Augmented stages in New Product Development; Promotion mix-Role and Relevance of advertising. Advertising-Planning, execution and evaluation. Distribution channel hierarchy; Role of each member in the channel; Analysis of business potential and evaluation of performance of the channel members. Marketing to Organisations-Segmentation Models; Organisational buying process. Marketing control. Customer relationship management including the concept of 'Relationship Marketing' Use of internet as a medium of marketing; Managerial issues in reaching consumers/organisation through internet.

Unit IV

Human Resource Management (HRM) -Significance; Objectives; Functions; A diagnostic model; External and Internal environment Forces and Influences; Organizing HRM function. Recruitment and Selection-Sources of recruits; Recruiting methods; Selection procedure; Selection tests; Placement and Follow-up: Performance Appraisal System-Importance and

Objectives; Techniques of appraisal system; New trends in appraisal system. Development of Personnel-Objectives; Determining Needs; Methods of Training & Development programs; Evaluation. Career Planning and Development-Concept of career; Career planning and development methods. Compensation and Benefits-Job evaluation techniques; Wage and salary administration; Fringe Benefits; Human resource records and audit. Industrial Relations-Importance; Industrial conflicts; Causes; Dispute settlement machinery. Collective Bargaining-Concept; Process; Pre-requisites; New trends in collective bargaining.

Unit-V

Fundamentals of Accounting; Preparation of Financial Statements, Income Statement and Balance Sheet; Financial Statement Analysis - Objectives and Techniques of Analysis. Ratio Analysis, Fund Flow Analysis and Cash Flow Analysis. Marginal Costing — Concept and Managerial Applications, Cost Volume Profit Analysis and Break Even Analysis. Standard Costing — Concept and Application, Variance analysis and reporting. Emerging issues in Accounting --- Responsibility Accounting, Human Resource Accounting and Inflation Accounting. Nature, Scope, objectives and Functions of Financial Management; Principals of Financial Management, Valuation of Securities; Pricing Theories, Capital asset pricing model and arbitrage pricing theory. Risk and return analysis. Cost of capital – concept and computation. Capitalization, over and under capitalization, theories of capitalization, Causes and remedies of over and under capitalization. Capital structure - Concept, relevance and irrelevance of capital structure, Net Income approach, Net operating income approach, traditional approach, MM Hypothesis; EBIT EPS Analysis; Leverage- Concept and significance of leverage analysis, operating, financial and combined leverages; Dividend Decision - Relevance and irrelevance of dividends, Gordon's Model, Walter's model, MM Hypothesis; Market value added and economic value added. Working Capital Management — determinants and financing. Cash Management, Inventory Management and Receivable Management.

Note:

Syllabi comprises for both part-II (basic conventional questions) and part-III (Advanced higher value questions) of the entrance test.

Deptt. of Management Studies University of Kashmir, Srinagar

Paper I: Research Methodology – Parasitology

Max. Marks: 100

Time allowed: 3 hours

Min. Marks: 50

Unit I: Parasitological Techniques

Light and Electron Microscopy; Microtomy; Micrometry and Photo Micrography; Fixatives with methods of fixation, preservation and staining techniques, Faecal, blood and urine examinations for diagnosis of parasitic diseases

Unit II: Scientific Writing

Research, Types and Formulations; Meaning of Research, Objective of Research, Motivation in Research; Research methods vs Methodology. Types of research – Descriptive vs Analytical, Applied vs Fundamental, Quantitative vs Qualitative, Concepttual vs Empiral; Research Process, Criteria of good Research, Formulating the research problem; Selecting the problem; Importance of literature review in research; Sources of Literature Review- primary and secondary sources, reviews, treatise, monographs, patents, journals, books and internet resources; Identifying research gap areas from literature review. Hypothesis, important considerations while making a hypothesis.

Unit III: Research Ethics

Ethics in Research Introduction to Bioethics, Ethical issues concerning various fields of biology; Embryonic stem cells and cloning, gene therapy and designer babies, genetically modified animals and crops. Ethical limits of animal use and welfare; Medical research ethics, Plagiarism and academic integrity; Mentor and mentee responsibilities and relationships, Record keeping, data, responsible authorship and Publications, Conflict of interest

Unit IV: Bio-Statistics

Method of data collection and presentation of data; Measures of central tendencies and dispersion; Correlation and regression analysis; Types of errors in testing hypothesis, level of significance, p-value, tests of significance (T-test, F-test, chisquare test and non-parametric test (one & two sample) Analysis of variance (ANOVA)- one way and two way; Probability and probability distribution – Normal, Binomial and Poisson.

Paper I: Research Methodology – Ichthyology

Max. Marks: 100

Time allowed: 3 hours

Min. Marks: 50

Unit I: Fish Biology and Biochemistry

Methods used for estimation of Physico-Chemical parameters in waterbodies: Dissolved Oxygen, Free Co2, transparency, total alkalinity, pH. Nitrite, nitrate and phosphorous. Estimation of Fish diversity, age, fecundity, Collection, prevalence and estimation of zooplankton in water body; Methods used in determination of moisture, protein, fat, ash and hematological parameters (Hb, RBC, PCV, WBC, ESR and Erythrocyte indices)

Unit II: Scientific Writing

Research, Types and Formulations; Meaning of Research, Objective of Research, Motivation in Research; Research methods vs Methodology. Types of research – Descriptive vs Analytical, Applied vs Fundamental, Quantitative vs Qualitative, Concepttual vs Empiral; Research Process, Criteria of good Research, Formulating the research problem; Selecting the problem; Importance of literature review in research; Sources of Literature Review- primary and secondary sources, reviews, treatise, monographs, patents, journals, books and internet resources; Identifying research gap areas from literature review. Hypothesis, important considerations while making a hypothesis

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Paper I: Research Methodology – Wildlife

Max. Marks: 100

Time allowed: 3 hours

Min. Marks: 50

Unit I: Field Methods

Sampling design and data collection, Vegetation sampling methods for wildlife habitat evaluation, Methods of wildlife population estimation: sample counts, drive counts, line transect method, point counts, pugmark census, pellet group count and counts of dens and burrows; Recording basic field observations through field signs like foot prints, feeding signs and animal droppings; Capture of wild animals; Use of camera, binoculars and GPS in Wildlife study; Quantitative methods of sampling behaviour : ad libitum, focal animal and scan sampling; Time-activity budgets, ethograms; Faecal analysis for evaluation of food and feeding in ungulates and carnivores

Unit II: Scientific Writing

Research, Types and Formulations; Meaning of Research, Objective of Research, Motivation in Research; Research methods vs Methodology. Types of research – Descriptive vs Analytical, Applied vs Fundamental, Quantitative vs Qualitative, Conceptual vs Empiral; Research Process, Criteria of good Research, Formulating the research problem; Selecting the problem; Importance of literature review in research; Sources of Literature Review- primary and secondary sources, reviews, treatise, monographs, patents, journals, books and internet resources; Identifying research gap areas from literature review. Hypothesis, important considerations while making a hypothesis.

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Paper I: Research Methodology – Entomology

Max. Marks: 100

Time allowed: 3 hours

Min. Marks: 50

Unit I: Collection, Preservation and rearing of Insects

Methods of collection and preservation of insects; Insect mounting techniques – temporary and permanent; Methods of insect rearing, Management and maintenance of insectaries; Chemical composition of various mountants and fixatives, Methods for preparation of cleansing agents, Berle's mountant Bio-chemical composition of various preservatives.

Unit II: Scientific Writing

Research, Types and Formulations; Meaning of Research, Objective of Research, Motivation in Research; Research methods vs Methodology. Types of research – Descriptive vs Analytical, Applied vs Fundamental, Quantitative vs Qualitative, Conceptual vs Empiral; Research Process, Criteria of good Research, Formulating the research problem; Selecting the problem; Importance of literature review in research; Sources of Literature Review- primary and secondary sources, reviews, treatise, monographs, patents, journals, books and internet resources; Identifying research gap areas from literature review. Hypothesis, important considerations while making a hypothesis.

Unit III: Unit III: Research Ethics

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Paper II: Recent Advances in Zoology

Time allowed: 3 hours

Min. Marks: 50

Max. Marks: 100

Unit I: Advanced Trends in Applied Zoology

- 1.1 Latest techniques in Fish- cultures & its products
- 1.2 Parasites & predators as biocontrol agents of pests
- 1.3 Conservation of Biodiversity; in-situ and ex-situ
- 1.4 Recent advancements in the diagnosis and control of parasitic diseases (Protozoan and Helminth)

Unit II: Nanotechnology, Recombinant DNA Technology & Advanced Genetics

- 2.1 Introduction to Nanotechnology and its applications in animal science
- 2.2 Production of monoclonal antibodies, biomolecules and hormones through rDNA technology
- 2.3 DNA forensics: DNA profiling methods, technical and ethical issues of DNA profiling
- 2.4 Epigenetics: epigenetic alterations to the genome, epigenetics and imprinting, epigenetics and cancer

Unit III: Recent Techniques in Zoology

- 3.1 PCR and blotting techniques, DNA fingerprinting and its applications
- 3.2 Phylogenetic systematics molecular markers used in the diagnosis of taxa
- 3.3 Centrifugation, electrophoresis and their applications
- 3.4 Application of remote sensing in animal sciences

Unit IV: Latest Advances in Immunology

- 4.1 Hypersensitivity: mechanism & types of reactions
- 4.2 Autoimmune diseases: causes and control
- 4.3 Tumour immunology: host immune response to tumours & tumour escape mechanisms
- 4.4 Tumour immune therapy: non-Specific and antigen specific treatment

Paper III: Specialized Paper

Max. Marks: 100

Time allowed: 3 hours

Min. Marks: 50

Specialized Paper The syllabus for this paper shall be based on recent developments in the area of research and will be drafted by the concerned supervisor and approved by the DRC.