Ph. D. Paper III

Department of Forestry and Environmental Science

Paper III Seed Science and Technology

Max.Marks 100

- Tree morphology in brief.
- Gymnosperm and Angiosperm seed.
- Physical characters of seed.
- Germination and treatment in seed.
- Seed dormancy.
- Seed legislation
-

Paper III Forest Ecology, Biodiversity and Climate Change

Max. Marks 100 Duration $2^1/2$ Hours

- Ecology ,Biodiversity & climate change
- New dimension in ecological research,
- Natural resources and their management
- Biodiversity uses and conservation
- Ecology and climatic change
- Impact of climate change on biodiversity
- Climate change process and mitigation approaches.

Syllabus
Pre-Ph.D. Course IN Chemistry
PAPER-III

Max. Marks. 100

Inorganic Chemistry

1. **Coordination chemistry:** Transition metal chemistry-first, second and third transition series. Coordination complexes: bonding in coordination complexes, nomenclature and isomerism. Kinetic study of chemical reactions. Catalysts and

catalysis: introduction, classification, industrial application of catalytic reaction, mechanism of catalysis, transition metal complexes as catalyst. Modification of catalysts formed, transition metal complexes as catalyst. Identification of catalysts formed, product formation, percent yield determination by various physicochemical properties, IR, UV, NMR and GLC.

Organic Chemistry

1. **Natural Product Chemistry:** Primary and secondary metabolites of plants, role of secondary metabolites and their biosynthesis, importance of natural product research its role in academic research, drug discovery and drug designing, techniques used in the extraction of natural products separation and purification methods, various spectroscopic techniques used in identification and structure elucidation of natural products, chemo diversity with respect to essential oil composition, significance of chemo systematic studies modern analytical techniques used in soil analysis, importance of soil chemistry in natural product research .
2. **Chemical Evolution:** Chemical evolution related to origin of life on earth and in other planets of the universe. Biological cell and its constituents**:** Structure and functions of amino acids, peptides, proteins, nucleic acid bases, pentose sugars (ribose and deoxyribose), nucleosides, nucleotides, nucleic acids (RNA & DNA) and lipids.Bio energetics, thermodynamics of biopolymer solutions and biopolymer interactions. Metal ions in biological systems, role of essential and trace metals in biological synthesis.

Physical Chemistry

1. **Nanotechnology:**Chemical methods of synthesis: Thermolysis and Plused Laser methods, Fabrication of carbon nanotubes. Determination of particle size and surface structure, Scanning Electron Microscopy, Field Ion Microscopy, Transmission Electron Microscopy, Carbon nanostructures, Size and shape dependent characteristic of nanomaterials, Electronic, Vibrational and Mechanical Properties. Applications of nanomaterials in computers, Fuel Cells, Chemical sensors, Chemical Catalysis. Nanomaterials in Biological Systems.

2. **Chemical Dynamics:** The concept of reaction rates, molecularity and order of reactions, general discussion about the types of order of reactions with suitable examples, pseudo order reactions, methods of determining order of reactions, effect of temperature on reaction rates, arrhenius equation, its importance and applications. Concept of energy of activation and its uses. General discussion on catalyst, catalysis, theories of catalysis, types of catalysis, kinetics of homogeneous and heterogeneous catalysis, kinetics of acid base catalysis, enzyme catalysis, michaelis-menton mechanism, general methods for working out the kinetics of complex reactions and complex enzyme reactions. Reactions in solutions, application of absolute theory of reaction rates to the reactions in solutions, influence of solvent on reaction rates, reactions between ions and molecules, reactions involving dipoles, influence of ionic strength, primary and secondary salt effects, effect of precipitation on reaction rates. General discussion on fast chemical reactions, kinetic study of fast reaction, stopped flow techniques, relaxation methods, flash photolysis and magnetic resonance

methods, spectrophotometric methods of studying fast chemical reactions, concept of temperature jump and temperature jump method. Redox reactions, hydrolysis, oscillatory reactions, theory of electron transfer.

3. **Solution chemistry:** Partial molal quantities, solvent activities, ionic interactions, molecular interactions in liquids, electrical properties of molecules conductivities of electrolytic solutions and ion-ion interactions. Macromolecules and aggregates; colloids, micelles and biological membranes, types of surfactants, viscosity and surface tension relations.

Ph.D. Syllabus
Paper-III
Fish Genetics and Biotechnology

1) **Mendelian principles:** Dominance, segregation, independent assortment, deviation from Mendelian inheritance.

2) **Concept of gene:** Allele, multiple alleles, pseudoallele

3) **RNA synthesis and processing:** Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.

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

5) **Control of gene expression at transcription and translation level**

6) **Molecular biology and recombinant DNA methods:** Isolation and purification of RNA and DNA (genomic and plasmid), analysis of RNA, DNA by gel electrophoresis, molecular cloning of DNA or RNA fragments generation of cDNA libraries, methods for analysis of gene expression at RNA and protein level, large scale expression analysis, such as micro array based techniques, Mitochondrial Genome analysis, RFLP, RAPD and AFLP techniques

7) **Computational methods:** Nucleic acid and protein sequence databases; data mining methods for sequence analysis, web-based tools for sequence searches.

8) **Population genetics:** Linkage mapping, Genetic Diversity, QTL mapping, Marker Assisted Selection

Plant Biotechnology

1. **DNA Technology**

   An overiew
   Recombinant DNA and gene technology
   Cloning and expression vector
   Molecular probes and gene libraries
   PCR and microarray
   DNA based molecular markers
2. **Plant cell and tissue culture**

   An introduction to laboratory organization, aseptic technique and media
   Callus culture
   Organogenesis
   Haploid production
   Cell suspension culture
   Protoplast culture
   Somaclonal variations
3. **Transgenic Plants**

   Methods for gene transfer in plants
   GM crops- Productivity and nutritional requirement
   GM crops- Resistance to biotic and abiotic stress
   GM crops- Molecular farming/ Pharming
4. **Plant Biotechnology for agricultural practices and Environment**

   Plant breeding and IPR
   Biodiversity and plant genetic resources
   Biofuels
   Plant biotechnology and climate change

Ph.D. Syllabus
Paper III (Specialization)
Kumaun University, Nainital

Molecular Virology

Introduction: History of Foot and Mouth Disease (FMD) and FMD virus, General characteristics of FMD virus, Physico-chemical properties of the virus, classification/ taxonomy.

Virus structure and morphology: X-ray crystallographic structure of FMDV, Capsid architecture, Principle of capsid assembly.

Genome Organization and Principle of replication: Structural organization of FMD Virus genome, Virus encoded proteins and their roles, Receptor interaction and Mode of virus entry, Mechanism of virus replication and translation.

Pathogenesis: Host range, Clinical signs, Pathogenesis, Strain virulence.

Epidemiology and Evolution: Global distribution and Indian perspective, Tools for epidemiological investigation, Trend of evolution, Serotype/genotype distribution, persistence and carrier status, Principles of virus evolution and quasispecies dynamics.

Diagnosis: Methods of FMD diagnosis, virus isolation, Purification, Serotyping and genome based newer diagnostic techniques, Serological techniques for surveillance and Differentiation of Infected and Vaccinated Animals (DIVA).

Vaccinology: Advances in FMD vaccinology, Natural and vaccine induced immunity to FMD virus, Issues related to vaccine efficacy and potency.

BIOTECHNOLOGY

PAPER III: Ph.D. Course (Bioremediation, Biotransformation and Biodegradation)

Bioremediation; Principals of bioremediation; Types of bioremediation technology; In situ and ex situ bioremediation; Bioremediation of VOCs.

Biodegradation; Factors affecting process of biodegradation; Methods in determining biodegradability; Contaminant availability for biodegradation.

Xenobiotics; Persistence and biomagnification of xenobiotic molecules; Microbial interactions with xenobiotics

Use of microbes (bacteria and fungi) and plants in biodegradation and biotransformation.

Solid waste management of industrial waste

Basic aspects of solid waste management; Current practices in India; Aerobic and anaerobic treatments of solid wastes; Composting; Vermiculture; Biogas generation; Treatment of hazardous wastes; Origin, sources and treatment strategies for polychlorinated biphenyls, pesticides, toxic pollutants, polymers, etc.

Biotechnology for management of resources

Need for management of resources; Role of environmental biotechnology in management of resources; Development of environmentally friendly processes such as integrated waste management.

Microbial degradation of textile dyes/pesticides/hydrocarbons and oils.

Enzymes involved in biotransformation.

Biotechnological application of hazardous waste management of soil; Use of microbial systems.

Texts/References

1. Bruce Rittman, Perry L. McCarty, Environmental Biotechnology: Principles and Applications, 2nd edition, McGraw-Hill, 2000.

2. Milton Wainwright, An Introduction to Environmental Biotechnology, Kluwer Academic Publishers, Boston. Hardbound, 1999.

3. Martin Alexander, Biodegradation and Bioremediation, 2nd edition, Academic Press, 1999.

Pre-Ph.D. Course work

Physics

Paper III

Max Marks:100

Paper-III Field of Specialization (theoretical High energy Physics)

Course material based on:

- **Relativistic notations, covariant formulation and Maxwell's equations.**
- **Review of Relativistic quantum mechanics.**
- **Review of Quantum Field theory and second Quantization.**
- **Quantization of Klein Gordon (real and complex), Electromagnetic and Dirac Fields.**
- **Feynman diagrams.**
- **Review of elementary particles, Fundamental interactions, Quark Model, Electroweak Interactions.**

- **Idea of Unitary and special unitary symmetry groups like U (1), SU (2), and SU (3)….. SU (N) and SL (2, C) groups.**
- **Gauge theories of fundamental interactions (Abelian, non-Abelian and Yang Mills Gauge theories), QED and QCD.**
- **Standard model and Grand Unified theories.**
- **Elementary idea of Super symmetry and Superstring theories.**
- **Basics of:**
    1. **Monopoles**
    2. **Dyons**
    3. **Tachyons**
    4. **Quaternions**
    5. **Octonions**

Signature
(Dr. O. P. S. Negi)
Department of Physics
S. S. J. Campus Almora

Signature
(P. S. Bisht)
Department of Physics
S. S. J. Campus Almora

Signature
Head of the Physics Deptt.
Kumaun University Nainital

Paper III (a): High Energy Physics

1. **Field Theoretical Formulation of QED**
   Covariant Lagrangian Formulation of Electromagnetic Field, Quantization of Electromagnetic field and its consequences, Photon Propagator and its use in Quantum Electrodynamics.

2. **Formulation of Modern Gauge Field Theory**

   Concept of gauge invariance, Global Symmetry in gauge field theory, Noether's Theorem, Symmetry Currents as Physical Currents, Spontaneous breaking of global symmetry. The Goldstone Theorem, Local symmetries the mechanism of their Spontaneous breaking, The Higgs mechanism and mass generation mechanism.

3. **Theories of Elementary Particle interactions**

   1. **Fundamental interactions, Status of Naïve Quark Model, Theory of Color Quark Model and Quantum Chromodynamics, Regge Classification of Hadrons, SU(4) Classification of Hadrons.**

   (b) Weak Interaction Fundamentals, IVB Concept and CVC Hypothesis, Weak

Isospin concept.

(c) Elementary idea of Unification of Fundamental Interactions with Special Reference to the Standard Model of Electroweak Interactions.

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Kumaun Unversity Nainital

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Campus Head
Department of Physics
D. S. B. Campus Nainital

Paper-III (b): Astrophysics

1. **Light and its prospectus, The Earth's Atomosphere and electromagnetic radiation, Astronomical telescopes: Optical telescopes, Radio telescopes, Hubble space telescope (HST), photometry, detectors and image processing, plank's theory of Black body radiation.**

2. **Birth of star, stellar positions, the celestial co-ordinates, star clusters, Hurtzsprung-russel diagram (H-R diagram), stellar magnitudes, stellar magnitudes, distance modulus, bolometric magnitude. The UBV system photometry, colour index of a star, stellar parallax, reddining and age determation of star clusters. Luminosity of stars, mass functions.**

3. **Hydrostatic equilibrium and dynamical stability of stars, stability condition for convective and radiative equilibrium. Solutions of lane-Emelen equations.**

4. **TOV equations for compact stars, equations of state, mass-radius diagram, definition of mass, res-mass, proper mass and binding-energy of lneutron stars. Chandrasekhar"s variational method for determine the pulsational stability of compact stars.**

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Paper – III ©: Spectroscopy

1. **Fundamental of Fluorescence Spectroscopy:**

   Electtronic spectrum and Franck condo rule. Concepts of bonding and antibonding. σ, π, η bonds, Fluorescence. Phosphorescence, Radiative and

non radiative processes. Fluorescence anisotropy, Jablonbski diagram. Life time and quantum yield. Stokes' shift. Solvent relaxation. Electronic energy transfer processes, Quenching processes of excited state.

2. **Laser Application:**
   Pulsed sources. Fundamentals of Lasers. Generation of ultra short pulses, Mode tocking. Mode pulling. G iant pulse dynamics, Nonlinear optics and its applications.
3. **Experimental Techniques & Instrumentation:**

   (a) Steady state techniques: Absorption, Emission and Excitation, CW sources, Monochromators, Detectors (PMT. CCD) Fluorescence spectrophotometer and spectrofluorometer.

   (b) Time resolved techniques: Pulse life time measurement. Analysis of time resolved decay of fluorescence intensity, time correlated single photon counting (TCSPC) technique.

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Paper-III(d): Advanced Condensed Matter Physics

1. **Crystal Symmetry:**

   Point group and space group. External symmetry elements of a crystal: AXIS OF SYMMETRY, PLANE OF SYMMETRY (MIRROR PLANE), POINT OF SYMMETRY (Point of inversions), Internal symmetry elements os a crystal: screw axis, glide plane, elementary idea of notation used to define symmetry elements of the crystal.

2. **Csrystal Structure:**

   Interpretation of powder photographs using graphical method and analytical method. Moving film method of x-ray crystallography.

3. **Lattice dynamics electronic properties:**

Anharmonicity, thermal expansion and thermal conductivity, Electron in periodic lattice, band theory of solids (metal, semiconductor and insulater). Effective mass, Introductory idea: magneto resistance (GMR and CMR) AND q hall effect (Integer and Fractional).

4. **Super Conductivity:**

Superconductivity Phenomenological, Semiphenomenological and microscopic theories of superconductors, Penetration depth, Coherence length, Josephson effects (DC, AC and microscopic interference). Elementary idea of high temperature superconductors.

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Head of the Physics Deptt.	**Campus Head**
Kumaun Unversity Nainital	**Department of Physics**
	D. S. B. Campus Nainital

REFERENCE BOOKS

Paper II: Advances in Physics

Charlie Harper:	***Introduction to Mathematical Physics***
H. Goldstein:	**Classical Mechanics**
B. S. Rajput:	**Mathematical Physics**
B. S. Rajput:	**Advanced Quantum Mechanics**
Schiff:	**Quantum Mechanics**
S. O. Pillai:	**Solid State Physics**
C. S. Kittle:	**Introduction to Solid State Physics**
White:	**Atomic Spectroscopy**
G. M. Barrow:	**Introduction to Molecular Spectroscopy**
G. King:	**Molecular Spectroscopy**
Davyodov:	**Quantum Theory**
Messiah:	**Quantum Mechanics Vol. I and II**
J. J. Sakurai:	**Quantum Mechanics**
Griffiths:	**Electrodynamics**
Jackson:	**Classical theory of fields**
Coughlin:	**Operational Amplifiers and Linear Integrated Circuits**
V. Rajaraman:	**Introduction to digital computer design (prentice Hall)**

Roychaudhary and Jain: **Operational Amplifier and Linear Integrated Circuits**
C. S. Kittle: **Introduction to Soliid State Physics**
Ziman: **Solid State Physics**
F Reif: **Statistical Physics/Mechanics**
R K Patharia: **Statistical Physics/Mechanics**
K Huang: **Statistical Physics/Mechanics**
S. N. Ghoshal: **Atomic and Nuclear Physics**
D. H. Perking: **Introduction to High Energy Physics**
G. D. Coughlan and J. E. Dodd: **The ideas of Particle Physics**
I. Kaplan: **Nuclear Physics**
R. R. Roy and B. P. Nigam: **Nuclear Physics (Theory and Experiments)**
D. B. Lichtenberg: **Unitary Symmetry and Elementary Particles**

Paper III(a) High Energy Physics

L. ryder ***Quantum Field Theory***
B. K. Agarwal: **Quantum Mechanics and Field Theory**
F Mandel and G Shaw: **Quantum Field Theory**
P. Roman **Quantum Field Theory**
B. S. Rajput **Advanced Quantum Mechanics**
I. J; Aitchison and A.J.Hey: **Gauge Theories in Particle Physics**
T. P. Cheng and L. F. Li: **Gauge Field Theory**
E. D. Commins: **Weak Interactions**

D. H. Perkins: Introduction to High Energy Physics

Paper III(b) Astrophysics

Abhyankaar K. D. ***Astrophysics, Galaxies and Stars***
Baidyanth Basu: **An Introduction to Astrophysics**
Motz: **Astrophysics**

Paper III(c) Spectroscopy

G. M. Barrow: ***Introduction to Molecular Spectroscopy***
Rohtagi and Mukhergee: **Fundamentals of Photochemistry**
J. R. Lacowicz: **Principle of Fluorescence Spectroscopy**
Demtroder: **Laser Spectroscopy**
J. F. Rabek: **Photophysics (Part I & II)**

Paper III(d) Advanced Condensed Matter Physics

C. S. Kittle:	***introduction to Solid State Physics***
C. S. Kittle:	**Quantum Theory of Solids**
Verma and Srivastava	**Crystallography for Solid State Physics**
Poole:	**Nanotechnology**
Steinhardt and Ostulong:	**The Physics of Quasi crystal**
Singh Shri:	**Introduction to Liquid crystals**
S. O. Pillai:	**Solid State Physics**
Ashcroft and Mermin:	**Solid State Physics**
Ziman:	**Solid State Physics**
K. L. Chopra:	**Thin Film**
Madelung:	**Solid State Physics**

Syllabus for Ph. D. Course work in Zoology
Paper III (Fish and Fisheries)

Max Marks:100

1. The principles of selection of culturable species – monoculture, polyculture and mixed fish culture.
2. Water quality requirements for Aquaculture: Role of temperature. pH, Salinity, dissolved oxygen, Ammonia, Nitrate, Nitrite, Phosphate, Biological Oxygen demand and Chemical Oxygen demand.
3. Integrated Aquaculture: Fish cum live stock farming, Paddy cum fish farming.
4. Fish Seed Technology: Natural collection, Bundh breeding, Induced breeding
5. The rational nutrition requirement of various culturable fish species including growth and length-weight relationship.
6. Fish health : Infection and disease in fish, Common fish pathogens, Routes of pathogen entry in fish. Methods of spreads of pathogens.

7. General survey of coldwater fisheries of Uttarakhand.

Syllabus for Ph. D. in Zoology: Paper III (Entomology)

1. Methods of insect collection, mounting and preservation of insects; Shanon-Wiener diversity index; secondary net production and degree of grazing.
2. Characters of taxonomic importance.
3. Principles of construction and use of dichotomous key in insect identification
4. Pest problem: Information required in dealing with a pest problem.
5. Pest control procedures.
    i) Biological control: Predators, Parasites and Pathogens
    ii) Chemical control: Contact Poisons, Systemic Poison, Stomach Poison, Fumigants.
    iii) Non – insecticidal control: Attractants, Repellants and Pheromones, Feeding deterrence.
    iv) The advantages and disadvantages of different pest control procedures.
    v) The economics of pest control.

Ph.D. Course Work Syllabus
Statistics Paper III- Paper on Specialization Research
Title of the Paper: Statistical and Econometric Modeling of Environmental Data

1. **Environmental Data:** Definition, Scope and Methods of collecting environmental data.
2. **Sampling techniques:** Types of Sampling, Choice of Sampling Procedures, sampling and non-sampling errors. Environmental Sampling. Methods of Environmental Sampling: Ranked Set Sampling, Adaptive Sampling, Network Sampling.

3. **Modeling of Environmental Data:** Probability models. Definition and scope. Formation of models.
4. **Econometric Modeling:** Linear and Multiple Regression, General Linear Models, Generalized Least Squares, OLS regression, simultaneous method, SURE method, VAR Model, ARCH and GARCH method, General Equilibrium Model for food crops.
5. **Bayesian Modeling of Environmental Data:** Concepts of Bayesian Inference. Modeling of environmental data using Bayesian Techniques. Gibbs Sampling, Markov Chain Monte Carlo (MCMC) methods.
6. **Win BUGS software:** Techniques of Bayesian modeling using Win BUGS software.
7. **Production Economics:** Cost of production, price and demand elasticity.
8. **Some issues related to Ph.D. topic:**

(a). Food Security: Issues and factors, Demand for food-models to estimate food demand, elasticties, changing food habits.

(b). World Energy Scenario: Alternative sources of energy- Global fuel markets, Energy from non-agriculture and agriculture sector and different available extraction technologies, conversions, India's energy situation and search for nonconventional sources, Environmental safety measures for energy use.

Suggested Readings:

1. **Baltagi, BH (2000):** Econometrics. 2nd ed. Springer, New York
2. **Monga, GS (1999):** Mathematics and Statistics for Economics. Vikas Publishing House Pvt. Ltd., New Delhi
3. **Robert, C and Casella, G. (2004):** Monte Carlo Statistical Mrthods. Springer Texts in Statistics, 2nd ed., Springer-Verlag, New York.
4. **Thompson, S.K. (2006):** Sampling. John Wiley.

Department of Geology, Kumaun University, Nainital

Ph.D. Paper III

Paper III (A)

MM 100

Slope Stability Analysis, Remote Sensing and GIS

Engineering properties of rocks. Concept of slope instability, factors of slope instability and methods of investigation - geological and geomorphological. Remote sensing application in the study of slope failures. Mapping of landslides and landslide hazard zonation. Spatial and temporal probability analysis. Application of GIS in slope stability analysis.

Suggested Readings

1. Tectonic Geomorphology by Keller
2. Remote Sensing by S.N. Pandey
3. Remote Sensing by O.P.Gupta
4. Geology and Environment by Bernard W. Pippkin
5. Fundamentals of Engineering Geology by F.C. Bell

Paper III (B)

MM 100

Radiolarian Micropaleontology

Radiolaria- Introduction, History of Radiolarian study, Biology, Skeletal - Shape, Wall structure and development. Preparation techniques.

Major Morphological Groups and their Subdivisions - Spumellaria and Nessellaria. Ecology, Planktonic adaptations, Biogeography, Evolution and Geologic History, Paleocology and Paleoceanography. Biostratigraphy. Radiolarian Productivity and Plate Tectonics

Suggested Readings

1. Introduction to Marine Micropaleontology by Bilal V. Haq and Anne Boersma
2. Elements of Micropalaeontology by G. Bignot
3. Radiolaria by O.R. Anderson

Ph.D. Course work
Botany III Paper

Max Marks: 100

BOTANY

PAPER- III: Ph. D. Course (Ethnobotany)

1. A general concept of Ethnobotanical research.
2. Review of literature with special reference to allotted research topic.
3. Methods of research in Ethnobotany.
4. CBD provision for assessment, benefit sharing and protection of traditional knowledge.
5. Preparation of scientific and technical papers, reports and popular articles.
6. Power point presentation of the research work.

BOTANY

PAPER- III: Ph. D. Course (Biodiversity)

1. General concept of Biodiversity research.
2. Review of literature with special reference to allotted research topic.
3. Research techniques in relation to field studies and laboratory work.
4. Protected areas network with special reference to Himalayan region.
5. Preparation of scientific and technical papers, reports and popular articles.
6. Power point presentation of research work.

BOTANY
PAPER III: Ph.D. Course (Ecology)

1. General concept of Ecological researches.
2. Review of literature with special reference to allotted research topic.
3. Research techniques in relation to field studies and laboratory work.
4. Experimental designing and sampling techniques. Application of statistical methods and interpretation of results.

5. Writing of at least one Research paper/Article of National/International repute with the help of available data/information.
6. Oral presentation of the research work.

BOTANY

PAPER III: Ph.D. Course (Plant Tissue Culture)

1. General Concepts in relation to plant tissue culture research.
2. Review of literature with special reference to topics allotted.
3. Research techniques used in plant tissue culture.
4. Experimental designing and application of statistical methods.
5. Paper writing with the help of available/collected data. The paper would be written according to the guidelines of referred National/International journal.
6. Oral presentation.

BOTANY

PAPER III: Ph.D. Course (Bryology)

1. General Idea of Bryophytes.
2. Concepts of Bryological researches.
3. Review of literature in relation to the selected topics.
4. Research Techniques: field study, collection, identification of plants and laboratory work.
5. Sampling, experimental design, application of statistical methods and interpretation of data.
6. Paper writing: one paper will be written by using available/collected (original) data. The paper would be written according to the guidelines of refereed notional/international journals.
7. Oral presentation of the research work.

BOTANY

PAPER III: Ph.D. Course (Mycology and Plant Pathology)

1. General idea of Mycology and Plant Pathology.
2. Review of literature with special reference to topic allotted.

3. Mycological techniques, collections, identification, isolation and culturing of fungi and pathogens.
4. Experimental designing and interpretation of data with statistical analysis.
5. Paper writing: formulation of data, presentation of data, publication of data and knowledge of journals.
6. Oral presentation of the research work.

Ph.D. Course work
Mathematics
Third Paper

Max.Marks: 100

(a) Optimization:

1. Linear Programming Problems, Simplex and Dual Simplex Method, Advanced Linear Programming (Revised Simplex and Dual Simplex Method), Reduction of the iteration process by the application of the matrices.
2. Some special algorithms- Transportation model (traditional transportation model, Non-traditional transportation model, determination of starting solution, North West corner method, Least cost method , Vogel Approximation Method VAM Iterative computation of the transportation algorithm, Assignment Model, Transshipment Model) Network Models (shortest route problems, Dijikstras algorithm, Floyds Algorithm, Minimal and maximal flow algorithms, CMP and PERT)
3. Inventory Models- Deterministic and Probabilistic
4. Basic concept of Probability, Probabilistic Inventory Models, Queuing Systems (pure birth model, pure death model, single and multi server model) Simulation Modeling
5. Non Linear Programming Algorithm(Unconstrained and constrained)
6. Statistical Inference , point estimation, interval estimation, testing of Hypothesis
7. Use of software (TORA, AMPLE, EXEL SOLVER)

Suggested readings:

1- Operations Research An Introduction by Hamdy A Taha
2- Practical Queuing Analysis, McGraw Hill
3- Non Linear Programming Theory and Algorithm- Bazarrra, Shrali , Shetty
4- An Introduction to Probability and Statistical Inference-Roussas

(b) Tensor and Riemannian Geometry:

Tensor theory, Scope of Tensor analysis, Ricci Tensor, Bianchi identities, Einstein Tensor, Riemannian and Euclidean spaces, Geodesics in R_n, Geodesic coordinates, The Riemannian –Christoffel Tensor and the Gaussian curvature, The Geodesic curvature of surface curves, Formulae of Kleingarten and Equation of Gauss and Codazzi, The mean and Total curvatures of a surface, The n-dimensional manifold, Riemannian Geometry, Curvature Tensors, Sub manifolds and hypersurfaces.

(c) General Relativity and Relativistic Astrophysics:

Solutions of Einstein's filed equations for static spherically symmetric fluid distributions, Mathematical formulation and boundary conditions, Neutron star model, Solutions for charged fluid distributions, Gravitational collapse of relativistic fluid spheres, Structure and evaluation of self Gravitating objects, Relativistic collapse of radiating stars, Gravitational collapse with heat flow, Quasar and supernova models, Relativistic dynamical models.

Suggested Reading:

1. General Relativity and Cosmology by J.B.Narlikar
2. General Relativity by S.K.Bose
3. Relativity by Eddington

(d) Nonlinear and Fuzzy Analysis

1. Metric space, Banach space, Linear operator, Linear functional.
2. Fundamental theorems for normed and Banach Spaces: Zorns lemma, Hahn Banach theorem, Banach Fixed Point theorem and its applications to Linear equations, Differential equation and Integral equation.
3. Generalisation of Banach contraction principle.
4. Fixed point theorem for multivalued mappings
5. Fuzzy metric space and fixed point theorems

Books Recommended:

1- Introductory Functional Analysis with application by ERWIN KREYSZIG.
2- Topology by Munkers.
3- Fixed Point theorems by Dugundji and Grenas.
4- Hand book of Metric Fixed Point Theory by W A Kirk and B Sims

Ph.D. Course work
Third Paper
Information technology

M. Marks: 100

Information Retrieval:

Information v/s data retrieval, The retrieval process, A taxonomy of IR models, Types of different IR models, Formal characterization of IR models, Types of different IR models, Retrieval evaluation, Retrieval performance evaluation, Recall and precision, Stemming algorithms, Types, Affix removal techniques- Lovins, Porters's algorithm, snowball framework, overview of Paise/Husk & Dawson algorithms, Stemming effectiveness, Lametization and Query optimization.

Suggested Reading:

1. Modern Information Retrieval by Ricardo Baeza-Yates and Berthier Riberio-Neto
2. Information retrieval: Algorithms and Heuristics, D.A. Grossman,O.Frieder, Springer
3. Introduction to modern information retrieval by C.J.Van Risjbergen, Cambridge.
4. Language modeling for information retrieval by W.B. Croft, J. Lafferty. Springer, 2003.

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