

Vishwavidyalaya Research Entrance test (VRET) Syllabus for Entrance Exam, Department of Anthropology, Botany, Biotechnology, Zoology

SECTION-A

Total Marks: 50

Paper 1: Research Methodology

UNIT I: 10 Marks

Basics of Research: Definition and overview of Research, Need for Scientific Research, Bibliography, Research Aptitude, Citations and its importance, Research Ethics.

UNIT II: 10 Marks

Data Collection and analysis: Methods of data collection, Observation and Collection of data, Sampling Methods- Data Processing and Analysis strategies. Measures of dispersion: Range, Mean deviation, Standard deviation, Standard error of mean.

UNIT III: 10 Marks

Basic statistical definitions and concepts: Variables and Variation, Frequency Distributions and Cumulative Frequency Distributions, Test of significance: Student t- test, ANOVA; Elementary idea of probability, Central tendencies.

UNIT IV: 10 Marks

General aptitude and Computation: Basics of computers and operating systems, Blood Relation Test, Input-Output Test, Data Analysis and Interpretation Test, Ratios Test, Permutations and Combinations Test, Percentage Test, Symbol Sequence Test.

UNIT V: 10 Marks

Reasoning: Number Series, Verbal Classification, Analogies, Matching Definition, Verbal Reasoning, Statement and Assumption, Statement and Conclusion, Cause and Effect, Logical Deduction, Making Judgments, Logical Problems, Analyzing Arguments.

Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)
A Central University

SYLLABUS

Section B: BOTANY

Marks: 50

UNIT I

10 marks

BIOLOGICAL MOLECULES, CELLULAR ORGANISATION AND FUNDAMENTAL PROCESSES

Structure of atoms, molecules and chemical bonds, Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins), Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.).

Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes.

Conformation of proteins (Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds).

Conformation of nucleic acids (A-, B-, Z-, DNA), t-RNA, micro-RNA). Stability of protein and nucleic acid structures, Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins.

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

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

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

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

Microbial Physiology: Growth, yield and characteristics, strategies of cell division, stress response.

DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms.

RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and

Janal
7-9-2018

Jushals
7/9/18

ash

Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)
A Central University

SYLLABUS

termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.

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

Control of gene expression at transcription and translation level: Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

UNIT II

10 marks

PLANT PHYSIOLOGY AND INHERITANCE SCIENCE

Photosynthesis: Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO₂ fixation-C₃, C₄ and CAM pathways. **Respiration and photorespiration:** Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway. **Nitrogen metabolism:** Nitrate and ammonium assimilation; amino acid biosynthesis. **Plant hormones:** Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action. **Sensory photobiology:** Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks. **Solute transport and photoassimilate translocation:** Uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates. **Secondary metabolites** - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles. **Stress physiology:** Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; mechanisms of resistance to biotic stress and tolerance to abiotic stress

Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance. **Concept of gene:** Allele, multiple alleles, pseudoallele, complementation tests. **Extensions of Mendelian principles:** Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. **Gene mapping methods:** Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. **Extra chromosomal inheritance:** Inheritance of mitochondrial and chloroplast genes, maternal inheritance. **Microbial genetics:** Methods of genetic transfers – transformation, conjugation, transduction and sexduction, mapping genes by interrupted mating, fine structure analysis of genes. **Quantitative genetics:** Polygenic inheritance, heritability and its measurements, QTL mapping.

Mutation: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of

Soni
7.9.2018

Jayshankar
27/9/18

[Signature]

Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)
A Central University

SYLLABUS

function, gain of function, germinal versus somatic mutants, insertional mutagenesis.

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

Recombination: Homologous and non-homologous recombination, including transposition, site-specific recombination.

UNIT III

10 marks

DIVERSITY OF LIFE FORMS PLANT ECOLOGY

Principles and methods of taxonomy: Concepts of species and hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy of plants, animals and microorganisms. **Levels of structural organization:** Unicellular, colonial and multicellular forms; levels of organization of tissues, organs and systems; comparative anatomy. **Outline classification of plants and microorganisms:** Important criteria used for classification in each taxon; classification of plants and microorganisms; evolutionary relationships among taxa. **Organisms of health and agricultural importance:** Common parasites and pathogens of humans, domestic animals and crops.

The Environment: Physical environment; biotic environment; biotic and abiotic interactions., **Habitat and niche:** Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement. **Population ecology:** Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection); concept of metapopulation – demes and dispersal, interdemec extinctions, age structured populations. **Species interactions:** Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis. **Community ecology:** Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. **Ecological succession:** Types; mechanisms; changes involved in succession; concept of climax. **Ecosystem:** Structure and function; energy flow and mineral cycling (CNP); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine). **Biogeography:** Major terrestrial biomes; theory of island biogeography; biogeographical zones of India. **Applied ecology:** Environmental pollution; global environmental change; biodiversity-status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. **Conservation biology:** Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).

UNIT IV

10 marks

APPLIED BIOLOGY, EVOLUTION AND CELL COMMUNICATION

Microbial fermentation and production of small and macro molecules. Tissue and cell culture

Sumit
7.9.2018

Sumit
7/9/18

at

Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)
A Central University

SYLLABUS

methods for plants. Transgenic plants, molecular approaches to diagnosis and strain identification. Genomics and its application to health and agriculture, including gene therapy. Bioresource and uses of biodiversity. Breeding in plants and animals, including marker – assisted selection. Bioremediation and phytoremediation. Biosensors.

Emergence of evolutionary thoughts: Lamarck; Darwin—concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; spontaneity of mutations; the evolutionary synthesis, **Origin of cells and unicellular evolution, Paleontology and evolutionary history:** The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale; origins of unicellular and multicellular organisms; major groups of plants, **Molecular Evolution:** Concepts of neutral evolution, molecular divergence and molecular clocks; molecular tools in phylogeny, classification and identification; protein and nucleotide sequence analysis; origin of new genes and proteins; gene duplication and divergence, Population genetics.

Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in plants.

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

UNIT V

10 marks

TECHNIQUES IN PLANT SCIENCE:

Molecular biology and recombinant DNA methods: Isolation and purification of RNA , DNA (genomic and plasmid) and proteins, different separation methods; analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, isoelectric focusing gels; molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems; expression of recombinant proteins using bacterial, animal and plant vectors; isolation of specific nucleic acid sequences; generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors; in vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms; protein sequencing methods, detection of post-translation modification of proteins; DNA sequencing methods, strategies for genome sequencing; methods for analysis of gene expression at RNA and protein level, large scale expression analysis, such as micro array based techniques; isolation, separation and analysis of carbohydrate and lipid molecules; RFLP, RAPD and AFLP techniques.

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

Handwritten signature
7.9.2018

Handwritten signature
7/9/18

Handwritten signature

Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)
A Central University

SYLLABUS

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

Radiolabeling techniques: Properties of different types of radioisotopes normally used in biology, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.

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

Methods in field biology: Methods of estimating population density of plants, ranging patterns through direct, indirect and remote observations, sampling methods and remote sensing methods.

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

Handwritten signature
7.9.2018

Handwritten signature
7/9/18

Handwritten signature

Vishwavidyalaya Research Entrance test (VRET) Syllabus for Entrance Exam, Department of Anthropology, Botany, Biotechnology, Zoology

SECTION-A

Total Marks: 50

Paper 1: Research Methodology

UNIT I: 10 Marks

Basics of Research: Definition and overview of Research, Need for Scientific Research, Bibliography, Research Aptitude, Citations and its importance, Research Ethics.

UNIT II: 10 Marks

Data Collection and analysis: Methods of data collection, Observation and Collection of data, Sampling Methods- Data Processing and Analysis strategies. Measures of dispersion: Range, Mean deviation, Standard deviation, Standard error of mean.

UNIT III: 10 Marks

Basic statistical definitions and concepts: Variables and Variation, Frequency Distributions and Cumulative Frequency Distributions, Test of significance: Student t- test, ANOVA; Elementary idea of probability, Central tendencies.

UNIT IV: 10 Marks

General aptitude and Computation: Basics of computers and operating systems, Blood Relation Test, Input-Output Test, Data Analysis and Interpretation Test, Ratios Test, Permutations and Combinations Test, Percentage Test, Symbol Sequence Test.

UNIT V: 10 Marks

Reasoning: Number Series, Verbal Classification, Analogies, Matching Definition, Verbal Reasoning, Statement and Assumption, Statement and Conclusion, Cause and Effect, Logical Deduction, Making Judgments, Logical Problems, Analyzing Arguments.