CSIR NET COMPLETE SYLLABUS ANALYSIS

Unit 1

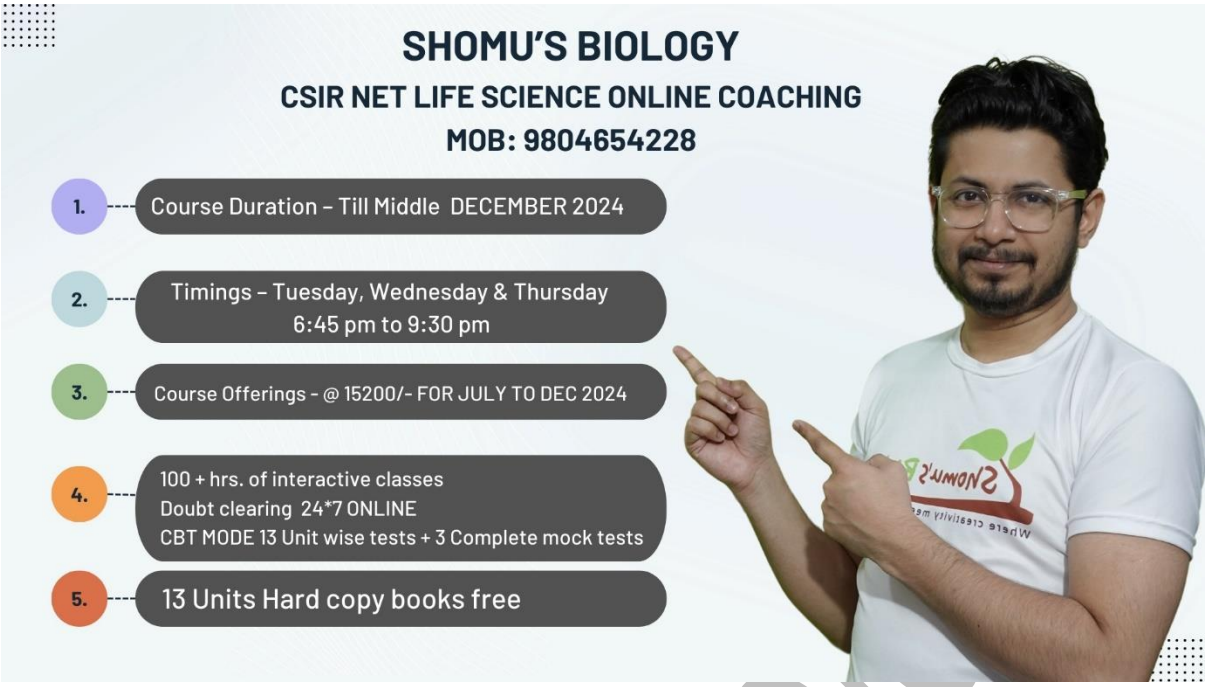
Most Important Topics (Repeated More Frequently)

1. **Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes**
    - Enzyme kinetics: Michaelis-Menten equation, Lineweaver-Burk plot, enzyme inhibition.
    - Enzyme regulation: Allosteric regulation, covalent modification.
    - Mechanism of enzyme catalysis: Lock and key model, induced fit model.
    - Isozymes: Examples and functions.
2. **Metabolism of carbohydrates, lipids, amino acids, nucleotides and vitamins**
    - Carbohydrate metabolism: Glycolysis, gluconeogenesis, pentose phosphate pathway.
    - Lipid metabolism: Beta-oxidation, fatty acid synthesis.
    - Amino acid metabolism: Urea cycle, transamination.
    - Nucleotide metabolism: Purine and pyrimidine synthesis and degradation.
3. **Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers**
    - Glycolysis: Steps and regulation.
    - Oxidative phosphorylation: Electron transport chain, ATP synthesis.
    - Bioenergetics: Thermodynamics in biological systems, high-energy compounds.
4. **Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins)**
    - Carbohydrates: Monosaccharides, disaccharides, polysaccharides.
    - Proteins: Primary, secondary, tertiary, quaternary structures.
    - Lipids: Fatty acids, triglycerides, phospholipids.
    - Nucleic acids: DNA, RNA structures and functions.
5. **Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.)**
    - Types of interactions: Examples and significance in biological molecules.
    - Role in protein folding and nucleic acid structure.

Least Important Topics (Less Frequently Mentioned)

6. **Structure of atoms, molecules and chemical bonds**
    - Atomic structure: Electron configuration, atomic orbitals.
    - Chemical bonds: Covalent, ionic, hydrogen bonds.
7. **Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties)**
    - pH and buffer: Henderson-Hasselbalch equation.
    - Reaction kinetics: Rate laws, activation energy.
    - Thermodynamics: Gibbs free energy, enthalpy, entropy.
    - Colligative properties: Osmosis, boiling point elevation, freezing point depression.
8. **Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds)**
    - Ramachandran plot: Allowed and disallowed regions.
    - Secondary structures: Alpha-helix, beta-sheet.
    - Protein motifs and domains: Examples and functions.
9. **Conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA)**
    - DNA helix types: A-DNA, B-DNA, Z-DNA.
    - tRNA structure: Cloverleaf model.
    - Micro-RNA: Function and significance.
10. **Stability of proteins and nucleic acids**
    - Factors affecting stability: Temperature, pH, denaturing agents.
    - Methods to study stability: Melting curves, denaturation assays.

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.



Unit 2

Most Important Topics (Repeated More Frequently)

1. **Cell division and cell cycle (Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle)**
    - Mitosis and meiosis: Detailed steps, phases, and regulatory mechanisms.
    - Regulation and control of the cell cycle: Key proteins and checkpoints.
2. **Membrane structure and function**
    - Structure of model membranes and lipid bilayer: Composition and properties.
    - Membrane protein diffusion, osmosis, and ion channels: Mechanisms and examples.
    - Active transport and membrane pumps: Detailed mechanisms.
    - Electrical properties of membranes: Resting membrane potential and action potentials.
3. **Structural organization and function of intracellular organelles**
    - Nucleus, mitochondria, and chloroplast: Structure and functions.
    - Endoplasmic reticulum, Golgi bodies, lysosomes, and peroxisomes: Role in cellular processes.
    - Cytoskeleton and its role in motility: Microtubules, microfilaments, and intermediate filaments.
4. **Organization of genes and chromosomes**
    - Operon models (e.g., lac operon): Gene regulation mechanisms.

- Chromatin structure: Euchromatin, heterochromatin, and chromosome organization.
- Transposons and repetitive DNA: Types and functions.

5. **Microbial Physiology**
    - Growth yield and characteristics: Phases of microbial growth.
    - Stress responses in microbes: Mechanisms and examples.

Least Important Topics (Less Frequently Mentioned)

While all the topics listed are significant, the order is based on the frequency of questions appearing in the analyzed papers. Here is the arranged order for clarity:

1. **Cell division and cell cycle** (Most Important)
2. **Membrane structure and function**
3. **Structural organization and function of intracellular organelles**
4. **Organization of genes and chromosomes**
5. **Microbial Physiology** (Least Important)

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.

Unit 3

Based on the analysis of the provided question papers, here is the list of topics arranged from most important to least important among the following list of topics:

1. **DNA replication, repair and recombination**
    - Enzymes involved in DNA replication
    - DNA damage and repair mechanisms
    - Homologous recombination
    - Site-specific recombination
2. **RNA synthesis and processing**
    - Transcription factors and machinery
    - Formation of initiation complex
    - RNA polymerases
    - RNA processing (capping, splicing, and polyadenylation)
    - RNA transport
3. **Protein synthesis and processing**

- Ribosome structure and function
- Formation of initiation complex and initiation factors
- Elongation and elongation factors
- Termination and genetic code
- Aminoacylation of tRNA and tRNA identity
- Post-translational modification of proteins

4. **Control of gene expression at transcription and translation level**
    - Regulating expression of phages, viruses, prokaryotic and eukaryotic genes
    - Role of chromatin in gene expression and gene silencing

Highlighted Topics:

1. **Enzymes involved in DNA replication**
2. **DNA damage and repair mechanisms**
3. **Transcription factors and machinery**
4. **RNA processing (capping, splicing, and polyadenylation)**
5. **Formation of initiation complex and initiation factors**
6. **Post-translational modification of proteins**
7. **Role of chromatin in gene expression and gene silencing**

These topics were identified as the most frequently addressed and emphasized in the question papers analyzed.

For detailed references to specific questions, you can refer to the following excerpts from the documents:

- **DNA replication, repair and recombination**: Frequent questions on DNA polymerases, replication origins, and repair mechanisms were observed .
- **RNA synthesis and processing**: Topics on RNA polymerases, transcription machinery, and RNA processing appeared multiple times .
- **Protein synthesis and processing**: Questions on ribosome function, translation initiation, and elongation were common .
- **Control of gene expression**: Regulation of gene expression and chromatin's role in gene silencing were also frequently tested .

Unit 4

Most Important Topics (Repeated More Frequently)

1. **Innate and adaptive immune system**
    - Cells and molecules involved in innate and adaptive immunity.
    - Antigens, antigenicity, and immunogenicity.
    - B and T cell epitopes, structure and function of antibody molecules.
    - Generation of antibody diversity, monoclonal antibodies, antibody engineering.
    - Antigen-antibody interactions, MHC molecules, antigen processing, and presentation.
    - Activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses.
    - Primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions.
    - Inflammation, hypersensitivity, autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria), and viral (HIV) infections.
    - Congenital and acquired immunodeficiencies, vaccines.
2. **Cancer**
    - Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes.
    - Cancer and the cell cycle, virus-induced cancer, metastasis.

- Interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

3. **Cell signaling**
    - Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors.
    - Signal transduction pathways, second messengers, regulation of signaling pathways.
    - Bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis, and quorum sensing.
4. **Host parasite interaction**
    - Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells.
    - Alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants.
    - Cell-cell fusion in both normal and abnormal cells.
5. **Cellular communication**
    - Regulation of hematopoiesis, general principles of cell communication.
    - Cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins.
    - Neurotransmission and its regulation.

Least Important Topics (Less Frequently Mentioned)

While all the topics listed are significant, the order is based on the frequency of questions appearing in the analyzed papers. Here is the arranged order for clarity:

1. **Innate and adaptive immune system** (Most Important)
2. **Cancer**
3. **Cell signaling**
4. **Host parasite interaction**
5. **Cellular communication** (Least Important)

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.

Unit 5

Most Important Topics (Repeated More Frequently)

1. **Gametogenesis, fertilization, and early development**

- Production of gametes, cell surface molecules in sperm-egg recognition in animals.
- Embryo sac development and double fertilization in plants.
- Zygote formation, cleavage, blastula formation, embryonic fields, gastrulation, and formation of germ layers in animals.
- Embryogenesis, establishment of symmetry in plants, seed formation, and germination .

2. **Basic concepts of development**
    - Potency, commitment, specification, induction, competence, determination, and differentiation.
    - Morphogenetic gradients, cell fate, and cell lineages, stem cells.
    - Genomic equivalence and the cytoplasmic determinants, imprinting.
    - Mutants and transgenics in analysis of development .
3. **Morphogenesis and organogenesis in animals**
    - Cell aggregation and differentiation in Dictyostelium.
    - Axes and pattern formation in Drosophila, amphibia, and chick.
    - Organogenesis: vulva formation in Caenorhabditis elegans, eye lens induction, limb development and regeneration in vertebrates.
    - Differentiation of neurons, post embryonic development: larval formation, metamorphosis.
    - Environmental regulation of normal development, sex determination .
4. **Programmed cell death, aging, and senescence**
    - Mechanisms and significance of programmed cell death.
    - Processes involved in aging and senescence in different organisms .
5. **Morphogenesis and organogenesis in plants**
    - Organization of shoot and root apical meristem.
    - Shoot and root development, leaf development and phyllotaxy.
    - Transition to flowering, floral meristems, and floral development in Arabidopsis and Antirrhinum .

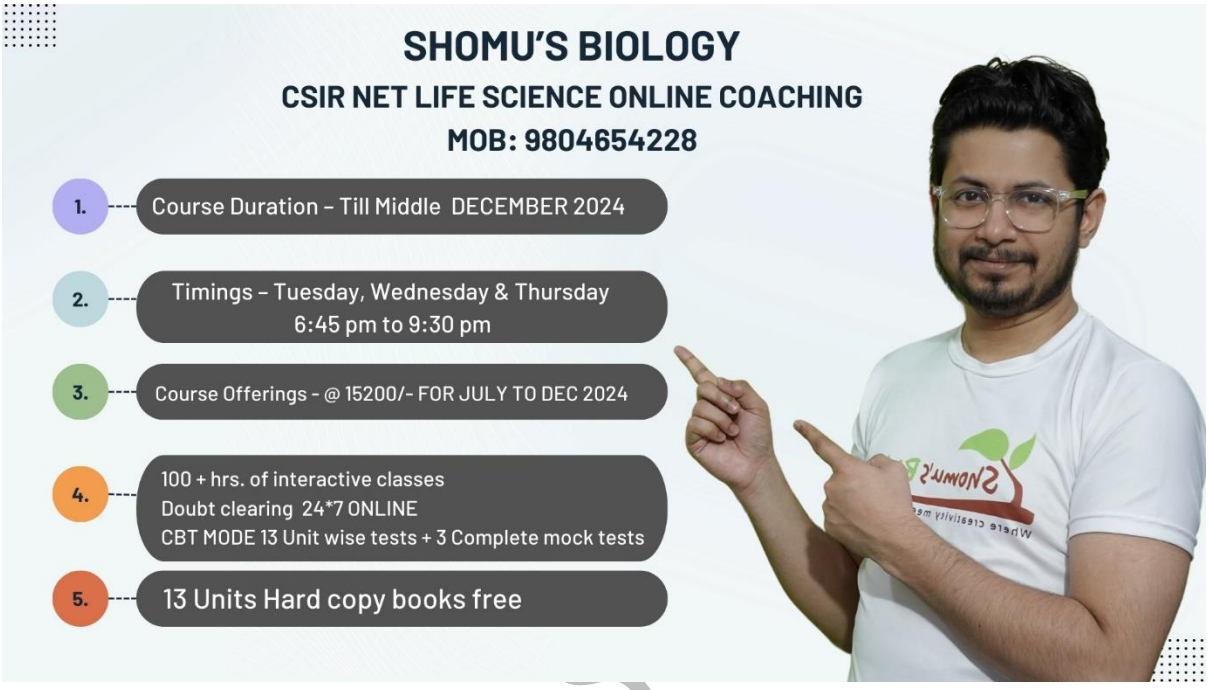
Least Important Topics (Less Frequently Mentioned)

While all the topics listed are significant, the order is based on the frequency of questions appearing in the analyzed papers. Here is the arranged order for clarity:

1. **Gametogenesis, fertilization, and early development** (Most Important)
2. **Basic concepts of development**

3. **Morphogenesis and organogenesis in animals**
4. **Programmed cell death, aging, and senescence**
5. **Morphogenesis and organogenesis in plants** (Least Important)

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.



Unit 6

Most Important Topics (Repeated More Frequently)

1. **Photosynthesis - Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO2 fixation-C3, C4 and CAM pathways.**
    - Mechanisms of electron transport and light harvesting complexes are frequently asked.
    - CO2 fixation pathways (C3, C4, and CAM) are also commonly covered.
2. **Respiration and photorespiration – Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.**
    - Citric acid cycle and plant mitochondrial electron transport are frequently tested.
    - Photorespiratory pathways and their components are also significant.
3. **Plant hormones – Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.**
    - Detailed questions on biosynthesis, storage, and transport of plant hormones.
    - Mechanisms of action and physiological effects of various hormones.

4. **Nitrogen metabolism - Nitrate and ammonium assimilation; amino acid biosynthesis.**
    - Nitrate and ammonium assimilation processes.
    - Amino acid biosynthesis pathways.
5. **Stress physiology – Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.**
    - Plant responses to biotic and abiotic stresses.
    - Mechanisms of stress resistance and tolerance.

Least Important Topics (Less Frequently Mentioned)

6. **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.**
    - Details on uptake and transport mechanisms.
    - Transpiration and photoassimilate translocation pathways.
7. **Sensory photobiology - Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.**
    - Mechanisms of action of different photoreceptors.
    - Stomatal movement and photoperiodism.
8. **Secondary metabolites - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.**
    - Biosynthesis pathways and roles of various secondary metabolites.

While all the topics listed are significant, the order is based on the frequency of questions appearing in the analyzed papers. Here is the arranged order for clarity:

1. **Photosynthesis** (Most Important)
2. **Respiration and photorespiration**
3. **Plant hormones**
4. **Nitrogen metabolism**
5. **Stress physiology**
6. **Solute transport and photoassimilate translocation**
7. **Sensory photobiology**
8. **Secondary metabolites** (Least Important)

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.

Unit 7

Most Important Topics (Repeated More Frequently)

1. **Blood and circulation - Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis**
    - Frequent questions on blood corpuscles, haemopoiesis, and blood groups.
    - Significant emphasis on haemoglobin and its functions, as well as immunity and haemostasis .
2. **Cardiovascular System - Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above**
    - Detailed questions on heart structure, ECG, and cardiac cycle.
    - Blood pressure regulation and heart as a pump were commonly tested .
3. **Respiratory system - Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration**
    - Focus on transport and exchange of gases, and comparative respiration across species.
    - Regulation of respiration, both neural and chemical, was frequently highlighted .

4. **Nervous system - Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture**
    - Common questions on neurons and action potentials.
    - Gross neuroanatomy and neural control of muscle tone were significant areas .
5. **Excretory system - Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance**
    - Frequent emphasis on kidney function and urine formation.
    - Regulation of water balance, blood pressure, and electrolyte balance were key topics .

Least Important Topics (Less Frequently Mentioned)

6. **Endocrinology and reproduction - Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, gametogenesis, ovulation, neuroendocrine regulation**
    - Focus on endocrine glands and hormone action mechanisms.
    - Reproductive processes and neuroendocrine regulation were less frequently covered compared to other topics .
7. **Digestive system - Digestion, absorption, energy balance, BMR**
    - Questions on digestion and absorption processes.
    - Energy balance and basal metabolic rate were covered but less frequently than other topics .
8. **Sense organs - Vision, hearing, and tactile response**
    - Primarily focused on vision and hearing.
    - Tactile response was the least mentioned among the sense organs topics .
9. **Thermoregulation - Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization**
    - Regulation of body temperature and acclimatization were covered, but not as frequently.
    - Physical and chemical regulation were less emphasized compared to neural regulation .
10. **Stress and adaptation**
    - Responses to stress and adaptation mechanisms were the least covered.
    - Focus was more on physiological adaptations to stress rather than the detailed mechanisms .

While all the topics listed are significant, the order is based on the frequency of questions appearing in the analyzed papers. This ranking highlights the emphasis placed on each topic in recent question papers, aiding in targeted exam preparation.

Unit 8

Most Important Topics (Repeated More Frequently)

1. **Gene mapping methods - Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants**
    - Linkage maps and molecular markers are frequently asked topics.
    - Tetrad analysis and somatic cell hybrids are also commonly covered.
2. **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**
    - Codominance, incomplete dominance, and gene interactions are frequently tested.
    - Linkage and crossing over, sex linkage, and genomic imprinting are significant areas of focus.
3. **Mendelian principles - Dominance, segregation, independent assortment**
    - Basic Mendelian principles such as dominance, segregation, and independent assortment are common topics.
    - These fundamental principles are frequently revisited in various contexts.
4. **Concept of gene - Allele, multiple alleles, pseudoallele, complementation tests**

- Alleles, multiple alleles, and complementation tests are often examined.
- Pseudoalleles and their significance are also covered.

5. **Human genetics - Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders**
    - Pedigree analysis and genetic disorders are frequently asked.
    - Lod scores and karyotyping are important but less frequent compared to pedigree analysis.

Least Important Topics (Less Frequently Mentioned)

6. **Microbial genetics - Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes**
    - Transformation, conjugation, and transduction are commonly covered.
    - Mapping genes by interrupted mating and fine structure analysis of genes are less frequent.
7. **Mutation - Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis**
    - Types of mutations and their detection are frequently discussed.
    - The various mutant types and their characteristics are less frequently emphasized.
8. **Recombination - Homologous and non-homologous recombination including transposition**
    - Homologous recombination and transposition are common topics.
    - Non-homologous recombination is less frequently covered.
9. **Quantitative genetics - Polygenic inheritance, heritability and its measurements, QTL mapping**
    - Polygenic inheritance and heritability are frequently tested.
    - QTL mapping is less emphasized compared to other topics.
10. **Structural and numerical alterations of chromosomes - Deletion, duplication, inversion, translocation, ploidy and their genetic implications**
    - Deletions, duplications, and inversions are common topics.
    - Translocations and ploidy changes are less frequently mentioned.
11. **Extra chromosomal inheritance - Inheritance of Mitochondrial and chloroplast genes, maternal inheritance**
    - Inheritance of mitochondrial and chloroplast genes are occasionally covered.

- Maternal inheritance is the least frequently mentioned topic among the list.

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.

Unit 9

Most Important Topics (Repeated More Frequently)

1. **Principles & methods of taxonomy**
    - **Concepts of species and hierarchical taxa**: Basic principles and definitions.
    - **Biological nomenclature**: Rules and applications.
    - **Classical & quantitative methods of taxonomy**: Techniques for plants, animals, and microorganisms.
2. **Levels of structural organization**
    - **Unicellular, colonial, and multicellular forms**: Differences and examples.
    - **Levels of organization of tissues, organs & systems**: Comparative anatomy and functional significance.
    - **Adaptive radiation and modifications**: Evolutionary adaptations and examples.
3. **Outline classification of plants, animals & microorganisms**
    - **Important criteria used for classification**: Key characteristics for different taxa.
    - **Classification of plants, animals, and microorganisms**: Overview and major groups.
    - **Evolutionary relationships among taxa**: Phylogenetics and evolutionary history .
4. **Organisms of health & agricultural importance**
    - **Common parasites and pathogens**: Effects on humans, domestic animals, and crops.
    - **Pathogenesis and disease mechanisms**: Common diseases and their impact.
5. **Natural history of Indian subcontinent**
    - **Major habitat types**: Characteristics and examples.
    - **Geographic origins and migrations of species**: Historical and contemporary movements.
    - **Common Indian mammals and birds**: Identification and significance.
    - **Seasonality and phenology**: Seasonal patterns and biological timing in the subcontinent.

Least Important Topics (Less Frequently Mentioned)

6. **Organisms of conservation concern**
    - **Rare and endangered species**: Identification and status.
    - **Conservation strategies**: Methods and effectiveness in preserving biodiversity.

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.

Unit 10

Most Important Topics (Repeated More Frequently)

1. **Habitat and Niche**
    - **Concept of habitat and niche**: Definitions and examples.
    - **Niche width and overlap**: Importance and implications.
    - **Fundamental and realized niche**: Differences and significance.
    - **Resource partitioning and character displacement**: Mechanisms and examples.
2. **Population Ecology**
    - **Characteristics of a population**: Key attributes.
    - **Population growth curves**: Types and examples.
    - **Population regulation**: Mechanisms and factors.
    - **Life history strategies (r and K selection)**: Definitions and examples.
    - **Concept of metapopulation**: Demes and dispersal, interdemic extinctions, age-structured populations.

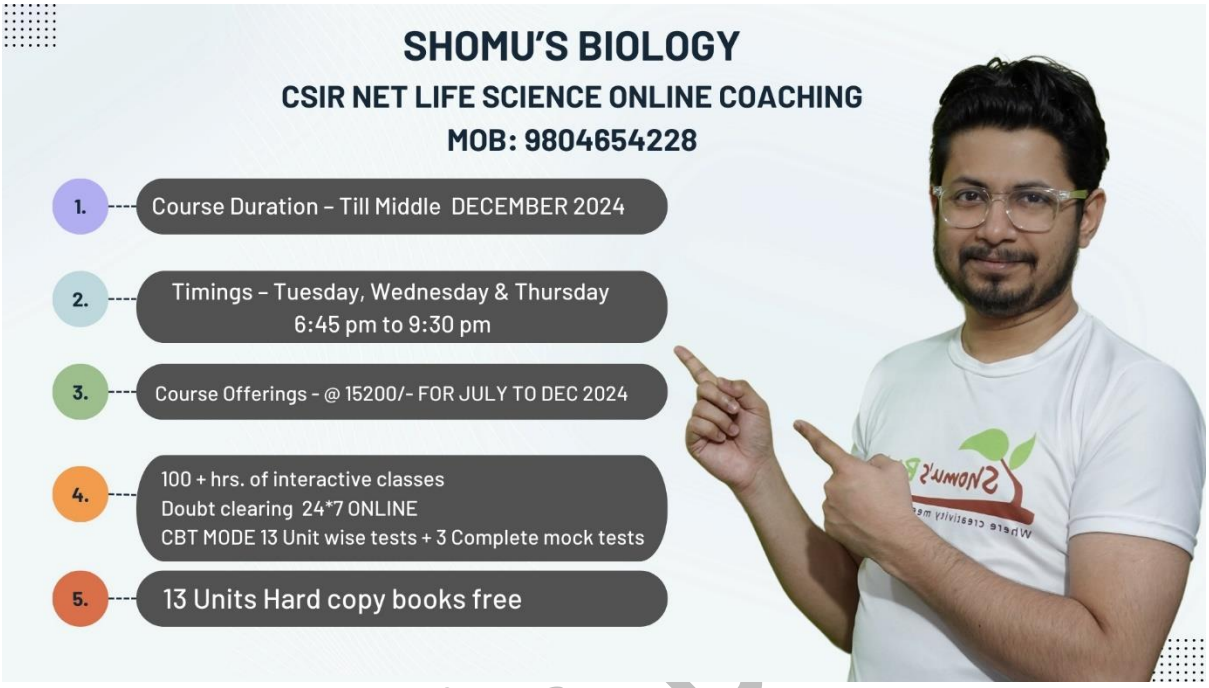
3. **Species Interactions**
    - **Types of interactions**: Interspecific competition, herbivory, carnivory, pollination, symbiosis.
    - **Interspecific competition**: Examples and significance.
    - **Pollination and symbiosis**: Mechanisms and importance.
4. **Community Ecology**
    - **Nature of communities**: Structure and attributes.
    - **Community structure and attributes**: Levels of species diversity and its measurement.
    - **Edges and ecotones**: Definitions and examples.
5. **Ecosystem Ecology**
    - **Ecosystem structure and function**: Energy flow and mineral cycling (C, N, P).
    - **Primary production and decomposition**: Processes and significance.
    - **Structure and function of some Indian ecosystems**: Terrestrial (forest, grassland) and aquatic (freshwater, marine, estuarine).

Least Important Topics (Less Frequently Mentioned)

6. **Ecological Succession**
    - **Types and mechanisms of succession**: Examples and processes.
    - **Changes involved in succession**: Concept of climax.
7. **Biogeography**
    - **Major terrestrial biomes**: Definitions and examples.
    - **Theory of island biogeography**: Principles and applications.
    - **Biogeographical zones of India**: Identification and characteristics.
8. **Applied Ecology**
    - **Environmental pollution**: Types and impacts.
    - **Global environmental change**: Causes and effects.
    - **Biodiversity status, monitoring, and documentation**: Methods and significance.
    - **Major drivers of biodiversity change and biodiversity management approaches**: Examples and strategies.
9. **Conservation Biology**
    - **Principles of conservation**: Definitions and strategies.
    - **Major approaches to management**: Examples and effectiveness.

- **Indian case studies on conservation/management strategy**: Project Tiger, Biosphere reserves.

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.



Unit 11

Most Important Topics (Repeated More Frequently)

1. **The Mechanisms**
    - **Population genetics**: Populations, Gene pool, Gene frequency.
    - **Hardy-Weinberg Law**: Concepts and applications.
    - **Natural selection, migration, and genetic drift**: Effects on gene frequency.
    - **Adaptive radiation, isolating mechanisms, and speciation**: Allopatric and sympatric speciation.
    - **Convergent evolution, sexual selection, and co-evolution**: Mechanisms and examples.
2. **Emergence of evolutionary thoughts**
    - **Lamarck and Darwin**: Concepts of variation, adaptation, struggle, fitness, and natural selection.
    - **Mendelism and mutation theory**: Contributions to evolutionary synthesis.
    - **The evolutionary synthesis**: Integration of Mendelian genetics with Darwinian evolution.
3. **Paleontology and Evolutionary History**

- **The evolutionary time scale**: Eras, periods, and epochs.
- **Major events in evolutionary history**: Origin of unicellular and multicellular organisms.
- **Primate evolution**: Stages and characteristics, including Homo evolution.

4. **Molecular Evolution**
    - **Neutral evolution, molecular divergence, and molecular clocks**: Concepts and applications.
    - **Molecular tools in phylogeny and classification**: Protein and nucleotide sequence analysis.
    - **Origin of new genes and proteins**: Gene duplication and divergence.
5. **Origin of cells and unicellular evolution**
    - **Origin of basic biological molecules**: Abiotic synthesis of organic monomers and polymers.
    - **Concepts of Oparin and Haldane**: Abiotic synthesis theories.
    - **Evolution of prokaryotes and eukaryotes**: Anaerobic metabolism, photosynthesis, and aerobic metabolism.

Least Important Topics (Less Frequently Mentioned)

6. **Brain, Behavior, and Evolution**
    - **Approaches and methods in behavior study**: Proximate and ultimate causation.
    - **Altruism and evolution**: Group selection, kin selection, and reciprocal altruism.
    - **Neural basis of behavior**: Learning, memory, cognition, sleep, and arousal.
    - **Social communication and dominance**: Use of space, territoriality, and social structures.
    - **Mating systems, parental investment, and reproductive success**: Strategies and examples.

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.

Unit 12

Most Important Topics (Repeated More Frequently)

1. **Microbial fermentation and production of small and macro molecules**
    - **Fermentation processes**: Continuous culture, batch fermentation, risk of contamination.
    - **Products of fermentation**: Examples and mechanisms.
2. **Application of immunological principles, vaccines, diagnostics, tissue and cell culture methods for plants and animals**
    - **Vaccines and diagnostics**: Principles and applications.
    - **Tissue and cell culture methods**: Techniques and uses in plants and animals.
3. **Genomics and its application to health and agriculture, including gene therapy**
    - **Gene therapy**: Techniques and applications.
    - **Genomics in health and agriculture**: Methods and examples.
4. **Transgenic animals and plants, molecular approaches to diagnosis and strain identification**
    - **Transgenic techniques**: Creation and applications in animals and plants.
    - **Molecular diagnosis and strain identification**: Methods and importance.
5. **Breeding in plants and animals, including marker-assisted selection**
    - **Marker-assisted selection**: Techniques and applications in breeding.
    - **Breeding methods**: Principles and examples.

Least Important Topics (Less Frequently Mentioned)

6. **Bioresource and uses of biodiversity**
    - **Biodiversity**: Importance and uses in different sectors.
    - **Bioresource management**: Techniques and examples.
7. **Bioremediation and phytoremediation**
    - **Bioremediation techniques**: Methods and applications.
    - **Phytoremediation**: Uses and importance.
8. **Biosensors**
    - **Types of biosensors**: Principles and applications.
    - **Uses in various fields**: Examples and importance.

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.

Unit 13

Most Important Topics (Repeated More Frequently)

1. **Molecular Biology and Recombinant DNA methods**
    - **Isolation and purification of RNA, DNA (genomic and plasmid), and proteins**: Techniques and applications.
    - **Molecular cloning of DNA or RNA fragments**: Bacterial and eukaryotic systems.
    - **Expression of recombinant proteins**: Using bacterial, animal, and plant vectors.
    - **DNA sequencing methods**: Strategies for genome sequencing.
    - **Analysis of gene expression at RNA and protein level**: Microarray-based techniques.
    - **RFLP, RAPD, and AFLP techniques**: Genetic analysis methods.
2. **Histochemical and Immunotechniques**
    - **Antibody generation**: Methods and applications.
    - **Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flow cytometry, and immunofluorescence microscopy**: Techniques and uses.
    - **In situ localization by techniques such as FISH and GISH**: Applications in molecular biology.
3. **Biophysical Methods**

- **Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR, and ESR spectroscopy**: Principles and applications.
- **Molecular structure determination using X-ray diffraction and NMR**: Techniques and examples.
- **Mass spectrometry and surface plasma resonance methods**: Uses in molecular biology.

4. **Statistical Methods**
    - **Measures of central tendency and dispersal**: Definitions and applications.
    - **Probability distributions (Binomial, Poisson, and normal)**: Examples and significance.
    - **Parametric and non-parametric statistics**: Differences and uses.
    - **Regression, correlation, and analysis of variance (ANOVA)**: Methods and applications.
    - **Basic introduction to multivariate statistics**: Examples and uses.
5. **Microscopic Techniques**
    - **Visualization of cells and subcellular components by light microscopy**: Techniques and applications.
    - **Scanning and transmission electron microscopy (SEM and TEM)**: Methods and examples.
    - **Image processing methods in microscopy**: Uses and significance.

Least Important Topics (Less Frequently Mentioned)

6. **Radiolabeling Techniques**
    - **Detection and measurement of radioisotopes**: Types and methods.
    - **Incorporation of radioisotopes in biological tissues and cells**: Techniques and applications.
    - **Molecular imaging of radioactive material**: Safety guidelines and methods.
7. **Electrophysiological Methods**
    - **Single neuron recording and patch-clamp recording**: Techniques and uses.
    - **Brain activity recording (ECG, PET, MRI, fMRI, CAT)**: Methods and applications.
    - **Pharmacological testing and brain stimulation**: Techniques and significance.
8. **Methods in Field Biology**
    - **Estimating population density of animals and plants**: Methods and applications.
    - **Sampling methods in the study of behavior**: Techniques and examples.

- **Habitat characterization**: Ground and remote sensing methods.

This ranking indicates the emphasis placed on each topic in recent question papers, highlighting areas of focus for exam preparation.