

**PLANT TAXONOMY**

*Scheme of examination:*

*MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

**UNIT - I**

Introduction, Principles of Taxonomy, Units of Classification, Concept of Genus and Species. Binomial Nomenclature, International Code of Botanical Nomenclature. Taxonomic Literature; Botanical Gardens and Herbaria.

**UNIT - II**

Development of Taxonomy and History of Different System of Classification. Bentham and Hooker's System of Classification. Engler and Prantle System of Classification. Evolutionary Trends in Angiosperms. Primitive and Advanced Characters.

**UNIT - III**

Diversity of flowering plants as illustrated by members of the families and economic importance of the following families: Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Apiaceae, Rubiaceae, Asteraceae.

**UNIT - IV**

Diversity of flowering plants as illustrated by members of the families and economic importance of the following families: Apocynaceae,

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Asclepiadaceae, Convolvulaceae, Solanaceae Acanthaceae, Lamiaceae,  
Euphorbiaceae, Liliaceae and Poaceae.

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भारत विज्ञान संस्थान  
वसुदेव विनायक  
पुणे, महाराष्ट्र, भारत

**EMBRYOLOGY AND ECONOMIC BOTANY**

*Scheme of examination:* MM: 35

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2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

**UNIT – I**

Ontogeny of the flower parts- development and variations. Structure of anther, microsporogenesis, Tapetum- types and function ,development of male gametophyte, structure of pollen grains.

Types of ovule, Megasporogenesis, development of female gametophyte(Embryosac) . Pollination,Pollination types. Fertilization, double fertilization, significance of double fertilization.

**UNIT - II**

Development of Dicot and monocot embryo, Formation of embryo, Types of embryo. Endosperm, Types of endosperm, Endosperm haustoria. . Polyembryony, Induced polyembryony. Parthenocarpy, Apomixis and adventive embryony.

**UNIT - III**

Basic concept of center of origin of cultivated plants. Food plants- rice, wheat, maize, potato, sugarcane. Vegetables: General account with a note on radish, onion, garlic, cabbage, spinach, cauliflower, cucumber, tomato, lady finger and pea. Fruits: General account with a note on apple, banana.

*Handwritten signatures and stamps:*  
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ber, mango, mulberry, jamun, watermelon, muskmelon, guava and orange.

Vegetable oil: groundnut, mustard and coconut.

#### UNIT - IV

Spices: General account with an emphasis on those cultivated in

Rajasthan: (Cumin, Capsicum, Coriander). Beverages: Tea and coffee.

Medicinal plants: General account with an emphasis on plant species

cultivated in Rajasthan (Senna, Isabgol, Safed musli). Fibers: Cotton and

jute. Wood: General account of sources of firewood, timber and bamboos;

Rubber. Ethnobotany: a general account.

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मूल्य अंकन  
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संस्था  
कृष्णराज विद्यापीठ  
वनस्पति शास्त्र विभाग  
राजस्थान विश्वविद्यालय, जयपुर

**MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY**

*Scheme of examination:*

*MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

**Unit – 1**

History of molecular biology: work of Chargaff, Watson and Crick model of DNA, Meselson and Stahl replication experiment ; Hershey and Chase experiment, Chromatin structure and gene expression, S. Benzer and gene concept. Kary Mullis and Polymerase chain reaction, Application of PCR technique, an overview of DNA fingerprinting and its use.

**Unit-2**

Central dogma , Reverse transcriptase and its application, Transcription in eukaryotes, RNA processing, capping, splicing and polyadenylation, Translation, initiation, elongation and termination. Jacob-Monod and Lac operon, Negative and positive control, attenuation and antitermination, structure of promoter.

**Unit-3**

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### PLANT ECOLOGY

*Scheme of examination:*

*MM: 35*

1. In Semester End Examination the candidate has to answer five questions in all. Each question will be of 7 marks. Candidate has to answer all questions in the main answer book only.
2. Q. No. 1 (objective/short answer type) will be compulsory having 14 questions (half mark each) covering entire syllabus.
3. Each paper is divided in four units. There will be two questions from each unit. Student has to answer one question from each unit.

#### **UNIT – I**

Plants and Environment: Atmosphere (gaseous composition and properties of four distinct zone viz. stratosphere, troposphere, mesosphere and thermosphere): water (distribution in biosphere and properties of water cycle): Morphological, anatomical and physiological responses of plants to water (Hydrophytes and Xerophytes). Light: global radiation, photosynthetically active radiation.

#### **UNIT II**

Zonation in water body: littoral, limnetic and profundal zones; photoperiodism, heliophytes and sciophytes, Temperature (Raunkier's classification of plants: megatherm, mesotherm, microtherm, heikistotherm; themoperiodicity and vernalisation). Soil (soil profile, development - weathering and maturation. Soil texture, soil types, role of pH, organic matter, soil water, soil nutrients. Interactions among organisms (neutralism, amensalism, allelopathy, competition, predation, parasitism, protocoooperation, mutuallism).

#### **UNIT III**

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Population, Community, Ecosystem and Phytogeography: Population ecotypes, ecades. Community characteristics: stratification, life forms and biological spectrum, frequency density and cover. Ecological succession: types (primary and secondary), mechanism: nudation, migration, ecesis, reaction and climax; xerosere, hydrosere.

#### UNIT IV

Ecosystems: Structure-abiotic and biotic components, trophic level, food chain, food web, ecological pyramids, energy flow (Box and Pipe model of Odum). Biogeochemical cycles of carbon and phosphorus; Vegetation types of India.

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Inorganic Chemistry

*Scheme of examination:*

*MM: 23*

*1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

**UNIT – I**

**Hard and Soft Acids and Bases (HSAB) :** Classification of acids and bases as hard and soft. Pearson's HSAB concept acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

**Unit-II**

**Metal-Ligand Bonding in Transition Metal complexes:** Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

**UNIT – III**

**Thermodynamic and Kinetic Aspects of Metal Complexes:** A brief outline of thermo- dynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

**UNIT - IV**

**Organometallic Chemistry-I:** Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyl and aryls of Li, Al, Hg, Sn and Ti.

**UNIT – V**

**Bioinorganic Chemistry I:** Essential and trace elements to Biological processes, Biological role of alkali and alkaline earth metal ions with special reference to  $Ca^{2+}$ .

Organic Chemistry

*Scheme of examination:*

MM: 23

1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

**UNIT – I**

**Organometallic and Organosulphur Compounds:** Organometallic Compounds: the Grignard reagents-formation, structure and chemical reactions. Organozinc Compounds: Formation and chemical reactions. Organolithium compounds: Formation and chemical reactions. **Organosulphur compounds:** Nomenclature, structural features, Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

**Unit-II**

**Heterocyclic Compounds-I:** Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions, with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

**Unit-III**

**Carbohydrates:** Classification and nomenclature monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+) - structures of glucose. Mechanism of mutarotation. Structure of

प्रधान  
सचिव  
राज्य विद्यापीठ  
राजसिंह कॉलेज

ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

#### Unit-IV

**Amino Acids:** Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis.

Preparation and reactions of  $\alpha$ -amino acids.

#### Unit-V

**Synthetic Polymers:** Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers.

Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes.

Natural and synthetic rubbers.

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प्रभारी

रसायन विभाग  
राजस्थान विश्वविद्यालय

Physical Chemistry

*Scheme of examination:*

MM: 24

*1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

**UNIT – I**

**Elementary quantum Mechanics-I:** Black-body, radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. Compton effect. De Broglie hypothesis Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator.

**UNIT - II**

**Elementary quantum Mechanics-II:** Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

**Unit-III**

**(a)Spectroscopy:** Introduction: Electromagnetic radiation, of the spectrum, basic features of different spectrometers, statement of the Born-Openheimer approximation, degrees of freedom.

**(b)Electronic Spectrum:** Concept of Potential Energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank Condon principle.

Qualitative description of  $\sigma$ ,  $\pi$  and  $n$  M.O. their energy levels and the respective transitions.

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**UNIT – IV**

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A diagram showing energy levels and transitions with arrows. Labels include  $\sigma$ ,  $\pi$ ,  $n$ , and  $\pi$ . There are also some scribbles and other markings.

**Solutions, Dilute Solutions and Colligative Properties-I:** Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient.

Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Experimental methods for determining osmotic pressure.

#### UNIT - V

**Solutions, Dilute Solutions and Colligative Properties-II:** Elevation of boiling point and depression in freezing point. Thermodynamic derivation of relation between molecular weight and elevation of boiling point and depression in freezing point. Experimental methods for determining elevation of boiling point and depression in freezing point. Abnormal molar mass, degree of dissociation and association of solutes.

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Inorganic Chemistry

Scheme of examination:

MM: 23

- 1 In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.

**UNIT – I**

**Magnetic Properties of Transition Metal Complexes:** Types of magnetic behavior, methods of determining magnetic susceptibility, spin-only formula. L-S coupling, correlation of  $\mu_s$  values and  $\mu_{\text{eff}}$  values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

**UNIT II**

**Electron Spectra of Transition Metal Complexes:** Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for  $d^1$  and  $d^9$  states, discussion of the electronic spectrum of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  complex ion.

**UNIT III**

**Organometallic Chemistry-II:** A brief account of metal ethylenic complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

**UNIT IV**

**Bioinorganic Chemistry-II:** Metalloporphyrins with special reference to haemoglobin and myoglobin. Nitrogen fixation.

**UNIT V**

**Silicones and Phosphazenes:** Silicones and phosphazenes as example of inorganic polymers, nature of bonding in triphosphazenes.

Organic Chemistry

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**UNIT – I**

**NMR Spectroscopy:** Nuclear magnetic resonance (NMR) spectroscopy. Proton Magnetic Resonance (H-NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constant, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

**UNIT II**

**Heterocyclic Compounds-II:** Introduction to condensed five and six-membered heterocycles. Preparation and reactions of indole, quainoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

**UNIT III**

**Organic Synthesis via Enolates:** Acidity of  $\alpha$ -hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate : the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes. Alkylation and acylation of enamines.

**UNIT IV**

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**Peptides, Proteins and Nucleic Acids:** Structures and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides.

Classical peptide synthesis, solid phase peptide synthesis. Structures of peptides and proteins. Levels of protein structure. Protein denaturation / renaturation.

**Nucleic acids:** Introduction. Constituents of nucleic acids.

**Ribonucleosides and ribonucleotides.** The double helical structure of DNA.

## UNIT V

**Fats, Oils and Detergents:** Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value, Soaps, synthetic detergents, alkyl and aryl sulphonates.

**Synthetic Dyes:** Colour and constitution (electronic concept).

Classification of dyes. Chemistry and synthesis of Methyl orange. Congo red. Malachite green. Crystal violet, Phenolphthalein. Fluorescein.

Alizarin and Indigo.





Physical Chemistry

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**UNIT – I**

**Molecular orbital theory, basic ideas-criteria for forming M.O. from A.O. construction of M.O's by LCAO -  $H_2^+$  ion, calculation of energy levels from wave functions, Hybrid orbitals -  $sp$ ,  $sp^2$ ,  $sp^3$  calculation of coefficients of A. O.'s used in these hybrid orbitals. Introduction to valence bond model of  $H_2$ , comparison of M.O. and V.B. models.**

**UNIT II**

**Rotational Spectrum:** Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution), determination of bond length, qualitative description of non-rigid rotator, isotope effect.

**UNIT III**

**Vibrational Spectrum:** Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups. Raman Spectrum concept of polarizability, pure rotational and pure vibrational Raman Spectra of diatomic molecules, selection rules.

**UNIT IV**

**Photochemistry:** Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-

Draper law, Stark -Einstein law, Jablosnski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions-energy transfer processes (simplex examples).

### UNIT V

**Physical Properties and Molecular Structure:** Optical activity, polarization - (Calusius-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties - paramagnetism, diamagnetism and ferromagnetism.

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**CHORDATES**

*Scheme of examination:*

**MM: 35**

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**UNIT – I**

Classification and characters of phylum Chordata (excluding extinct forms) up to orders (up to subclass in mammals).

Habit, habitat and Salient features of Herdmania, Branchiostoma and Petromyzon :

Ascidian tadpole larva and its metamorphosis  
Ammocoete larva.

**UNIT - II**

**Comparative Anatomy** (with special reference to Scoliodon, Frog, Varanus, Columba and Rabbit)-

Integument - skin structure and development of placoid scales, feathers and hair.

Basic plan of vartebtrate endoskeleton  
Alimentary canal

**UNIT - III**

**Comparative Anatomy** (with special reference to Scoliodon, Frog, Varanus, Columba and Rabbit)-

Origin and evolution of Heart and aortic arches.  
Respiratory system.

**UNIT - IV**

**Comparative Anatomy** (with special reference to Scoliodon, Frog, Varanus, Columba and Rabbit)-

Brain  
Urinogenital system.

**UNIT - V**

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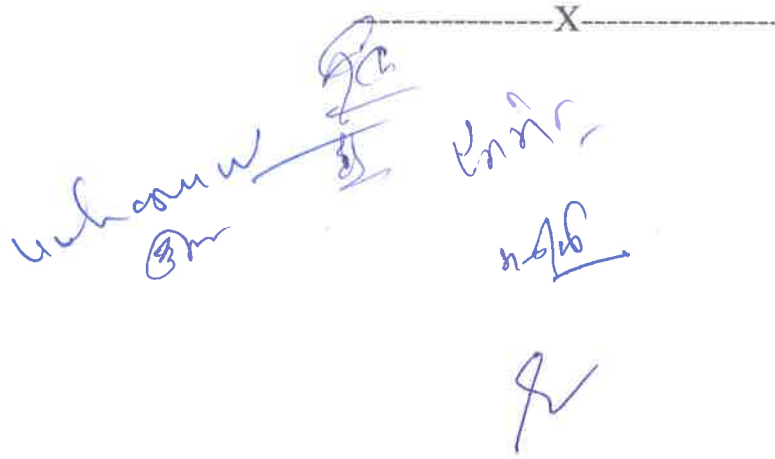
Pisces – Types of scales and fins, Migration Parental care.

Amphibia - Parental care.

Reptilia - Poisonous and non-poisonous snakes,

Aves - Flight adaptation, Bird migration.

Mammals - Dentition.



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प्रश्नोत्तर  
श्री श्री विज्ञान विभाग  
राजस्थान विश्वविद्यालय, अजमेर

**DEVELOPMENTAL BIOLOGY**

*Scheme of examination:*

**MM: 35**

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

**UNIT - I**

Historical review: types & scope of embryology

Gametogenesis: Spermatogenesis and oogenesis

Fertilization mechanism & its significance, Parthenogenesis

**UNIT - II**

Types of eggs

Planes and patterns of cleavage

morulation and blastulation

gastrulation - Fate maps, morphogenetic cell movements, significance.

**UNIT - III**

Development of chick up to 4 – somite stage.

Extra-embryonic membranes in chick.

Mammalian placentation - types, classification & functions.

**UNIT - IV**

Embryonic induction; primary organizer, differentiation, competence;

Regeneration in vertebrates

Apoptosis

**UNIT - V**

Metemorphosis in Frog & Insects.

Teratological effects of Xenobiotics.

Embryonic stem cells, Brief idea on cloning.

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राजस्थान विश्वविद्यालय, अजमेर

Brief account of biology of aging.

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- A large, stylized 'W' or 'u' shape at the top left.  
- 'Am' written below the 'W' shape.  
- 'R' written below 'Am'.  
- 'B/L' written to the right of 'Am'.  
- 'Emi' written to the right of 'B/L'.  
- 'nAb' written to the right of 'Emi'.

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विज्ञान विभाग  
विद्यालय, अहमदाबाद

**EVOLUTION AND ETHOLOGY**

*Scheme of examination:*

**MM: 35**

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

**UNIT – I**

Chemical origin of Life.

Lamarckism & Darwinism.

Natural selection (Differential reproduction).

Genetic basis of evolution.

**UNIT II**

Variation and Speciation.

Isolation

Adaptations.

Palaeontology: fossils: Geological division of the Earth crust: imperfection of fossil record.

**UNIT III**

Zoogeographical distribution: Principal zoogeographical regions of the world with reference to their mammalian fauna.

Continental drift.

Study of Extinct forms: Dinosaurs, Archaeopteryx

**UNIT IV**

Introduction of Ethology.

Concept of Ethology: Fixed action pattern, Sign stimulus, Innate releasing mechanism, Action specific energy, motivation, imprinting & learning.

Methods of studying brain behaviour: Neuroanatomical, neurophysiological,

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महाराष्ट्र विद्यापीठ  
मुंबई विद्यापीठ, अहमदनगर

neurochemical techniques

**UNIT V**

**Pheromones and behaviour.**

**Hormones and behaviour.**

**Societies: Characteristics & advantages with special reference to Honey Bee,  
Deer & Monkey.**

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**ECOLOGY AND BIOSTATISTICS**

*Scheme of examination:*

**MM: 35**

1. *In Semester End Examination there will be 10 questions in all, 2 from each unit. Candidate has to answer any 5 questions, taking one from each unit.*

**UNIT – I**

Basic concepts of ecology & limiting factors.

Biotic and Abiotic Factors.

Ecosystem- Components of ecosystem, energy flow, ecological pyramids, Food chain, Food web

**UNIT II**

Biogeochemical cycles (O<sub>2</sub>, CO<sub>2</sub>, H<sub>2</sub>O, N and P).

Populations- Characteristics, Growth and its analysis.

Intraspecific & interspecific: Commensalism & Mutualism.

Community ecology: Characteristics & structure, Ecotone, Edge effect

**UNIT III**

Ecological Succession (Xerosere and Hydrosere).

Major Biome.

Habitat Ecology-Aquatic, Marine, Terrestrial - Desert, Forest.

**UNIT IV**

Conservation and management of natural resources.

Pollution.

Green house effect, El-Nino and La-Nino effects.

Wild life conservation and management.

Biodiversity of Rajasthan, Concept of threatened species.

**UNIT V**

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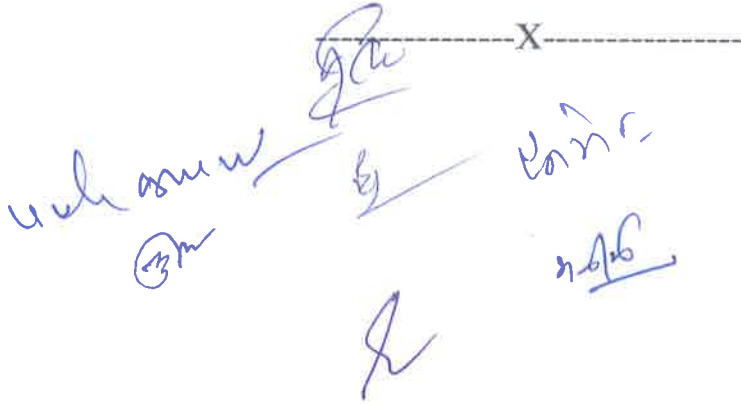
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राजस्थान विश्वविद्यालय, अलवर

Introduction, scope and application of Biostatistics.

Frequency distribution, Graphical presentation of data.

Mean, mode, median and their significance.

Standard deviation and standard error.



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श्री. विद्या विभाग  
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