1.3.1 Institution Integrates Crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into the Curriculum.

Nilkanthrao Shinde Science and Arts College, Bhadrawati Dist – Chandrapur

Institution integrates crosscutting issues relevant to Professional Ethics, Gender, Human Values, Environment and Sustainability into the Curriculum –

S. N.	Programme name	Paper	Description
1	B. Sc. Sem III & IV All Subjects	Skill Development	Environmental Studies
2	B. Sc. Sem I Microbiology	Paper- I	Fundamentals of Microbiology
3	B. Sc. Sem II Microbiology	Paper- II	Applied Microbiology
4	B. Sc. Sem III Microbiology	Paper- II	Food, Soil Microbiology
5	B. Sc. Sem IV Microbiology	Paper- I	Industrial Microbiology
6	B. Sc. Sem I Zoology	Core Paper II	Cell Biology
8	B. Sc. Sem II Zoology	Core Paper IV	Paper- II Genetics and Evalution
9	B. Sc. Sem III Zoology	Core Paper V and Practical	Paper- I Animal Diversity
10	M. Sc. Sem. III Zoology	Paper X	Fresh Water Aquaculture
11	M. Sc. Sem. III Zoology	Paper XI	Aquaculture and Rural Development
12	B. Sc. Sem I Botany	Paper- I	Plant Diversity-I
13	B. Sc. Sem I Botany	Paper- II	Plant Diversity-II
14	B. Sc. Sem III Botany	Paper- I	Reproductive Biology of Angiosperms, Plant Growth and Development
15	B. Sc. Sem III Botany	Paper- II	Plant Biochemistry and Physiology
16	B. Sc. Sem V Botany	Skill Enhancement Course	Gardener Training, Mashroom Culture
17	B. Sc. Sem V Botany	Paper- I	Genetics and Plant Breeding- I
18	B. Sc. Sem V Botany	Paper- II	Genetics and Plant Breeding- II
19	B. A. Sem I Sociology	----	Soci0logy
20	B. A. Sem II Sociology	----	Indian Society

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SCHEME AND SYLLABUS UNDER CHOICE BASED CREDIT SYSTEM (CBCS) FOR B.Sc. ZOOLOGY

Semester	Core Course (12)	Ability Enhancement Compulsory Courses AEC(2)	Skill Enhancement (Foundation) Courses SEC(4)	Discipline Specific Elective (DSE)
I	CC - Chemistry P -I CC - Chemistry P -II CC - Botany P -I CC - Botany P -II CC - Zoology P -I CC - Zoology P -II	English (1) Marathi (1)		
II	CC - Chemistry P -III CC - Chemistry P -IV CC - Botany P -III CC - Botany P -IV CC - Zoology P -III CC - Zoology P -IV	English (1) Marathi (1)		
III	CC - Chemistry P -V CC - Chemistry P -VI CC - Botany P -V CC - Botany P -VI CC - Zoology P -V CC - Zoology P -VI		Environmental Studies	
IV	CC - Chemistry P -VII CC - Chemistry P -VIII CC - Botany P -VII CC - Botany P -VIII CC - Zoology P -VII CC - Zoology P -VIII		Environmental Studies	
	CC - Chemistry P -IX CC - Chemistry P -X CC - Botany P -IX CC - Botany P -X CC - Zoology P- IX CC - Zoology P -X		(Any one) 1.Apiculture 2. Sericulture 3.Vermiculture and Lac Culture 4.Aquarium fish Culture	**DSE-Chem I** **DSE - Bot I** **DSE - Zoo I** (Any One) 1.Parasitology 2.Applied Zoology 3. Insect Vectors and disease 4 Aquatic Biology

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VI	CC - Chemistry P -XI CC - Chemistry P -XII CC - Botany P -XI CC - Botany P -XII CC - Zoology P -XI CC - Zoology P -XII		1.Medical diagnosis 2.Public Health & Hygiene 3.Research Methodology and Instrumentation	**DSE- Chem II** **DSE - Bot II** **DSE - Zoo II** (Any One) 1. Immunology 2.Animal Biotechnology 3.Micro-technique, Bioinformatics and Biostatistics

Discipline Core Courses (DCC) : Zoology

1. Animal Diversity
2. Cell Biology, Genetics and Evolutionary Biology
3. Comparative Anatomy and Developmental Biology of Vertebrates
4. Physiology and Biochemistry

Discipline Specific Electives (DSE): Zoology (Any two)

1. Applied Zoology
2. Animal Biotechnology
3. Aquatic Biology
4. Immunology
5. Reproductive Biology
6. Insect, Vector and Diseases

Skill Enhancement Courses (SEC): Zoology

1. Apiculture
2. Aquarium Fish Keeping
3. Aquatic Biology
4. Medical Diagnostics
5. Public Health and Hygiene
6. Sericulture

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CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS

PROGRAMME- BACHELOR OF SCIENCE (B.Sc.), SEMESTER-III

SUBJECT- ZOOLOGY, THEORY (CREDITS 2)

CORE PAPER V

USCZOT05

Paper I - ANIMAL DIVERSITY (CHORDATES) AND COMPARATIVE ANATOMY

Unit- I **(12 periods)**

1. Urochordata- General characters, Ascidian tadpole and retrogressive metamorphosis
2. Cephoalochordata- General characters, Amphioxus - External morphology and digestive system.
3. Cyclostomata- General characters, external morphology of-Petromyzon and Myxine.
4. Pisces- General characters and Classification up to order; Osmoregulation in Fishes, Accessory respiratory organs.

Unit-II **(12 periods)**

1. Amphibia– General characters and Classification up to order, Parental care and Neoteny.
2. Reptilia- General characters and Classification based on temporal vacuities. Snake venom, Poison apparatus & biting mechanism, Poisonous and non poisonous snake

Unit-III **(12 periods)**

1. Aves – General characters and classification up to order. Flight adaptations (Morphological, Anatomical and Physiological), Birds migration and its significance
2. Mammals – General characters and classification up to order. Prototheria, Metatheria and Eutheria.

Unit-IV : Comparative anatomy **(12 periods)**

1. Comparative account of derivatives of integuments (Scale and horn).
2. Comparative account of aortic arches and heart.
3. Types of receptors (General cutaneous receptors and chemoreceptor).
4. Comparative account of Urinogenital system.

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CHOICE BASED CREDIT SYSTEM (CBCS) SYLLABUS

PROGRAMME- BACHELOR OF SCIENCE (B.Sc.), SEMESTER-III

SUBJECT- ZOOLOGY, PRACTICAL (CREDITS 2)

CORE COURSE-V & VI

USZOP03

PRACTICAL

B.Sc. II (Zoology), Semester-III

(Animal Diversity, Comparative Anatomy & Physiology and Biochemistry-I)

Section A - Animal Diversity, Comparative Anatomy

1. Identification and Classification of museum specimens

a. Urochordates : Herdmania, Salpa, Doliolum

b. Cephalochordate : Amphioxus

c. Cyclostomata: Myxine, Petromyzon

d. Pisces : Pristis, Torpedo, Notopterus, Exocoetus, Clarius, Ophiocephalus, Catla, Labeo, Mrigal

e. Amphibia : Bufo, Salamandra, Ichthyophis

f. Reptilia : Chameleon, Varanus, Phrynosoma, Draco, Tortoise, Naja , Bungarus, Hydrophis.

g. Aves : Owl, Woodpecker, Kingfisher, Kite, Duck, Parrot

h. Mammals: Squirrel, Mongoose, Bat, Loris, Rabbit

2. Anatomical Observations

Anatomical observations, demonstration and detailed explanation of the following with the help of ICT tools/ models/ charts/ photographs etc. (Any locally available fish)

a) Digestive system

b) Reproductive system

c) Brain and Cranial Nerves

3. Study of skeleton of Rabbit or Fowl

(Loose bones of skull not to be studied)

5. Study of permanent slides-

Fish scales - Placoid, Cycloid and Ctenoid, V.S. Skin of Frog and Mammal.

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C.B.C.S. SYLLABUS

PROGRAMME- BACHELOR OF SCIENCE (B.Sc.), SEMESTER-II

SUBJECT- ZOOLOGY,THEORY (CREDITS 2)

CORE PAPER IV

USZOT04

PAPER -II - GENETICS AND EVOLUTION

Unit 1: Introduction to Genetics **(12 Periods)**

Mendelian Genetics - Mendel's work on transmission of traits. Laws of Genetics
Interaction of genes - Incomplete dominance and Codominance. Multiple alleles. Lethal alleles. Epistasis. Sex linked inheritance.extra-chromosomal inheritance (Kappa particles)

Unit 2: Linkage, Crossing Over, Syndrome and Mutation **(12 Periods)**

Linkage and crossing over
Down's Syndrome, Klinefelter'sSyndrome, Turner's Syndrome
Chromosomal Mutations - Deletion. Duplication.Inversion.Insertion. Translocation. Aneuploidy and Polyploidy
Gene mutations- Induced and Spontaneous mutations.

Unit 3: History of Life **(12 Periods)**

Major Events in History of Life - Urey-Miller Experiment. Oparin theory
Introduction to Evolutionary Theories - Lamarckism. Darwinism. Neo-Darwinism
Direct Evidences of Evolution - Types of fossils. Incompleteness of fossil record. Dating of fossils. Evolution of horse

Unit 4: Processes of Evolutionary Change **(12 Periods)**

Isolating Mechanisms: Natural selection (Example: Industrial melanism)
Types of natural selection (Directional. Stabilizing. Disruptive). Artificial selection
Species Concept - Biological species concept (Advantages and Limitations): Modes of speciation (Allopatric, Sympatric and peripatric)
Macro-evolution - Macro-evolutionary Principles (example: Darwin's Finches)
Extinction - Mass extinction -Causes. and Role ofextinction in evolution

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C.B.C.S. SYLLABUS

PROGRAMME- BACHELOR OF SCIENCE (B.Sc.), SEMESTER-I

SUBJECT- ZOOLOGY, THEORY (CREDITS 2)

CORE PAPER II

USZOT02

Paper II - CELL BIOLOGY

Unit 1: **(12 Periods)**

Cell theory- Protoplasmic theory, Organismal theory, Prokaryotic and Eukaryotic cell.

Biological membrane-Chemical composition, Sandwich model and Fluid Mosaic Model, Osmosis, Passive and Active transport (Sodium Potassium ion pump), Exocytosis, Endocytosis (Pinocytosis &Phagosytosis)

Unit 2: **(12 Periods)**

Nucleus- Occurrence, Position and Morphology, Ultrastructure, Composition and functions of Nuclear membrane, Nuclear pore complex.

Nucleolus-Structure and Functions

Chromosome-Structure and types, Nucleosome model

Giant Chromosome- Lampbrush and Polytene Chromosome

Unit 3: **(12 Periods)**

Mitochondria- Ultrastructure, Electron transport mechanism and Oxidative Phosphorylation.

Endoplasmic reticulum-Structure, Type and Function

Golgi Complex-Structure and Function

Unit 4: **(12 Periods)**

Lysosome-Structure,Function and Polymorphism

Ribosome-Structure (Lake's Model),types, Biogenesis of ribosome, Function and Polyribosome

Cell cycle,Mitosis, Meiosis, Significance.

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M.Sc. (Zoology)

Semester-III

Paper-X, Special Group-Aquaculture-I **(CREDIT - 4)**

Fresh water Aquaculture

Unit-I

1.1 Aquaculture: Definition, importance and present status in India.
1.2 Physicochemical conditions of pond water.
1.3 Biological conditions – Aquatic vegetation. Association of macro vegetation.
1.4 Plankton: Seasonal distribution, Diurnal movement and its role in fisheries.

Unit-II

2.1 Pond soil, Chemical conditions.
2.2 Pond ecosystem: Trophic level, food chain and food web in pond.
2.3 Methods of productivity measurement.
2.4 Planning and construction of fresh water fish farm.

Unit-III

3.1 Biology of culturable indigenous carps.
3.2 Biology of culturable exotic carps.
3.3 Reproductive system and breeding behavior in Indian carps.
3.4 Fisheries of major river systems in India.

Unit-IV

4.1 Reverine collection of fish seed.
4.2 Fish breeding in wet and dry bundhs.
4.3 Induced breeding by hypophysation.
4.4 Hatching techniques and types of hatcheries.

Semester –III

Paper-XI, Special Group-Aquaculture-II **(CREDIT - 4)**

Aquaculture and Rural Development

Unit-I

1.1 Culture of zooplankton
1.2 Prawn culture & Methods of breeding
1.3 Culture of crabs
1.4 Pearl culture / Oyster culture

Unit-II

2.1 Development and advancement of aquaculture in India.
2.2 Larvivorous fishes in relation to public health.
2.3 Culture of Exotic and transplanted fishes
2.4 Breeding and care of fresh water aquarium fishes.

Unit-III

3.1 Definition of economics and application of economic principles to aquaculture.

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Microbiology B. Sc. I Semester-I(CBCS)

Course Code –USMBT1	Paper – I	Marks - 50
Credit : 2		Total Hours : 48

FUNDAMENTALS OF MICROBIOLOGY

Unit No.	Content	Hrs.
1	**History and Development of Microbiology**	12
	Introduction to Microbiology, Branches of Microbiology, Scope of Microbiology Development of Microbiology as a discipline with special reference to the work of following scientists: Antony Van Leeuwenhoek, Louis Pasteur, Robert Koch, Martinus Beijerinck, Sergei Winogradsky,Alexander Flemming,Selman Waksman, A.M. Chakraborty,H.G. Khorana	
	Theory of Abiogenesis and Biogenesis: Aristotle's notion about spontaneous generation, John Needham experiment **Biogenesis:** Experiments of F. Redi, , Spallanzani, Schulze and Schwann, Schroder and Von Dusch, Louis Pasteur and John Tyndall	
2	**Study of Prokaryotic Cell**	12
	Difference between Eukaryotic and Prokaryotic cell. **Structure and functions of bacterial cell components:** (a) Cell wall (b) Cytoplasmic membrane (fluid Mosaic model (c) Capsule & Slime layer(d) Flagella (e) Nuclear material (f) Plasmids (g) 70 S Ribosome **Endospore:** Structure, Stages in Sporulation	
3	**Microbial Taxonomy**	12
	Aim, Principles and Parts of Taxonomy: General Criteria used for bacterial classification, concept of taxa, Genus, Species, Strain, Family, Order, Division, Kingdom; **Various approaches of bacterial taxonomy:**(Artificial, Natural & Evolutionary) Two (Linnean), Three (Haeckel), four (Stanier-Van Niel) and Five kingdom (Whittaker) concept. **Methods of classification of bacteria:** Intuitive method, Numerical taxonomy and Genetic relatedness (DNA base composition, DNA homology, r-RNA homology & sequencing methods). Bergey's Manual of Determinative and Systematic Bacteriology.	
4	**Viruses, Archaebacteria and Fungi**	12
	Viruses - 1. General characteristics of viruses. 2. Structure of viruses. 3. Lytic Cycle of T4 Phage. 4. Lysogenic cycle of Lambda phage 5. Classification of Viruses: LHT classification. 6. Methods of cultivation of animal viruses.	
	Archaebacteria: General characteristics, Unique characters. Groups of Archaebacteria (Methanogens, Halophiles, Thermophiles).	
	Fungi: General characteristics, Methods of reproduction of Molds and Yeasts.	

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Microbiology B. Sc. I Semester-II(CBCS)

Course Code – USMBT04	**Paper – II**	**Marks - 50**
Credits: 2		**Total Hours : 48**
USMBT05	**APPLIED MICROBIOLOGY**	

Objective: To make the students to understand and aware the fundamentals of National Mission on Environmental cleanliness, health and hygiene.

Unit No.	Content	Hrs.
1	**Air Microbiology:** a. Definition and composition of air. b. Sources of microorganisms in air. c. Enumeration of microorganisms in air: Solid and liquid impingement technique (Lemons sampler, Anderson sampler) d. Room sterilization techniques (Radiation, Fumigation, Laminar air flow) e. Droplet, Aerosol, Droplet nuclei and Droplet infection, Air borne diseases (List with causative organisms)	12
2	**Water Microbiology:** a. Indicators of excretal pollution. b. Collection and handling of water sample for analysis c. Bacteriological analysis of water for coliforms(MTDT, MPN) d. Identification of faecal and non-faecal coliforms by (IMViC and Eijkmann test) e. Chlorination of water (mechanism), Different methods of Chlorination f. Water borne diseases(List with causative organisms)	12
3	**Sewage Microbiology** a. Definition and Types of Sewage, Composition and strength of sewage (BOD, COD, ThOD) b. Microbiology of sewage. c. General Flow Sheet of Waste Water Treatment d. Preliminary, Primary and Secondary sewage treatment methods. (Screening, Grit Removal, Septic Tank , Imhoff Tank, Trickling Filter, Activated Sludge, Oxidation Pond, Rotating Biological Contactor)	12
4	**Milk Microbiology** a. Definition and composition of milk, sources of contamination of milk. b. Desirable and undesirable changes in milk. c. Milk borne diseases (List with causative organisms). d. Bacteriological examination of milk by SPC, DMC, Reductase test (MBRT), checking of pasteurization of milk by phosphatase test. e. Milk products- Cheese, Yoghurt (production)	12

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Microbiology B. Sc. II Semester-III (CBCS)		
Course Code –USMBT06	Paper-II	Marks: 50
Credits: 2		Total Hours :48
FOOD, SOIL MICROBIOLOGY AND MICROBIAL ECOLOGY		
Objective: To make the students to understand the fundamentals of Food, Soil and Microbial Ecology.		

Unit No.	Content	Hrs
1	**Food Microbiology** a) Definition and types of food, Sources of contamination in food b) Microbial examinations of food c)Spoilage and its types (Different types of spoilages with suitable examples) d) Preservation of food (Physical, chemical and biological methods) e) Food borne diseases, food infections and food poisoning (Botulism, *Staphylococcal* intoxication and Salmonellosis) f) Concept of HACCP	12
2	**Soil Microbiology** a) Composition of soil, Types of soil b) Humus Formation (Nature and Characteristics) c) Compost : Aerobic and anaerobic methods of composting d) **Elemental transformations:** Carbon cycle; Nitrogen cycle; Phosphorous cycle	12
3	**Microbial Association and Nitrogen Fixation** a)Positive and Negative Microbial associations with examples Symbiosis, Syntrophism, Synergism, Commensalism, Parasitism, Competition, Antibiosis. b) **Biological Nitrogen fixation -** Nitrogen fixing bacteria, Symbiotic and non-symbiotic nitrogen fixation(in detail), Process of nodulation in legume, Nitrogenase complex, Nif gene. c) Biofertilizers and Biopesticides	12
4	**Environmental Biotechnology** a) Microbial leaching - Bioleaching of Copper and Uranium. b) Microbial enhanced oil recovery (MEOR). c) Bioremediation, Acid mine drainage, Desulfurization of coal d) Biogas plant, construction and working mechanism e) Biodegradation of Pesticides (Xenobiotic)	12

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B. Sc. Sem IV

Course Code – USMBT07	Paper-I	Marks: 50
Credits: 2		Total Hours :48

INDUSTRIAL MICROBIOLOGY

Objective: To make the students to understand the fundamentals of Industrial processes and mechanisms for the product formation.

Unit No.	Content	Hrs
1	**Basics of Industrial Microbiology** Definition, Scope and Development of Industrial Microbiology, Bioreactor / Fermentor (Definition, Characteristics of Ideal, General design and Different parts of typical Fermenter). Antifoaming agents. **Fermentations**: Definition and Types- Batch and Continuous (comparison), Solid and Liquid state, Surface culture and Submerged culture, Single, Dual / Multiple culture. **Types of Fermentor**: Continuous Stirred Tank Fermenter, Bubble Column reactors, Air Lift Fermenter Tower fermenter, Fluidized Bed Fermenter, Packed bed reactors (In Brief)	12
2	**Fermentation Media and Microbes in Industrial Microbiology** A) Commonly used raw materials for the fermentation process with composition: Saccharine materials (Cane and beet molasses, Fruit juices, Cheese whey), Starchy materials (Cereals and root tubers), Cellulosic materials (Sulphite waste liquor), Nitrogenous materials (Corn steep liquor, Soybean meal, Pharmamedia, Distillers soluble), Precursers B). Industrially important microorganisms & their products (List) C) **Upstream Process:** Primary and Secondary screening, Strain improvement, Inoculum build up, Scale up of fermentation process, Tolerance studies.	12
3	**Downstream Processing** **Downstream process** . Cell mass removal by precipitation, filtration & centrifugation . Cell disruption by physical & chemical methods . Solvent recovery process . Chromatographic separation and industrial product recovery . Drying & crystallization. Quality testing of end product. . Packaging and marketing of product	12
4	**Production of Important Fermentation products** Industrial production, Fermentation media, Microbes involved, Biochemistry, fermentation conditions, Product recovery operations and Uses of.. • Biomass – Baker's Yeast • Beverages –Wine (Production of Wine) • Antibiotics(Penicillin) • Organic acid (Citric acid) • Amino acids(Lysine) • Enzymes (Amylase)	12

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GONDWANA UNIVERSITY, GADCHIROLI

SYLLABUS

For

B. Sc.

BOTANY

Semester I & II

Under

Choice Based Credit System

(CBCS)

(With effect from: 2020-21)

SEMESTER –I				
Papers	**Title of the Paper**	**Th/Pr**	**Int. Assessment**	**Total Marks**
Paper – I	**Plant Diversity I** (Micro- organisms, Algae, Fungi & Plant Pathology)	50 Marks	10 Marks	60 Marks
Paper –II	**Plant Diversity II** (Bryophyta, Pteridophyta, Gymnosperm & Paleobotany)	50 Marks	10 Marks	60 Marks
Practical	Based on Theory Paper –I & II of Semester – I	30 Marks	---	30 Marks
Internal Assessment: Based on Assignment, Seminar, Unit Test & overall attendance and performance of the student.				

SEMESTER –II				
Papers	**Title of the Paper**	**Th/Pr**	**Int. Assessment**	**Total Marks**
Paper – I	Morphology and Anatomy of Angiosperms	50 Marks	10 Marks	60 Marks
Paper – II	Taxonomy & Diversity of Angiosperms	50 Marks	10 Marks	60 Marks
Practical	Based on Theory Paper –I & II of Semester – II	30 Marks	---	30 Marks
Internal Assessment: Based on Assignment, Seminar, Unit Test & overall attendance and performance of the student.				

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B.Sc. SEMESTER – I

Paper – I

Plant Diversity- I

(Micro-organisms, Algae, Fungi and Plant Pathology)

(48 Periods)

UNIT – I **(12 Periods)**

1. **General characteristics of life** (Growth, metabolism and reproduction).
2. **Viruses:**
   a) General characteristics and nature of viruses (living and non-living).
   b) Morphology and Structure of T4 phase (DNA virus) and TMV (RNA virus).
   c) Transmission of viruses in plants w.r.t. Grafting, Seeds, Contact, Air and water, Soil, Agricultural tools, Smokers, Store house and Insects.
3. **Mycoplasama:**
   General characteristics and Structure.
4. **Bacteria:**
   a) **Structure of bacterial cell.**
   b) **Morphology of bacteria** (Bacillus, Coccus, Spirillum and Vibrio).
   c) **Economic importance** : **i) Useful bacteria** (Agriculture, Industries and Medicine)
   ii) Harmful bacteria (Pathogenic bacteria, Food spoiling, Food poisoning and Denitrification.

UNIT – II **(12 Periods)**

Algae

1. **General Characters.**
2. **Habitats**: Aquatic, Terrestrial and Algae unusual habitats.
3. **Range of thallus structure in algae**: Unicellular, Colonial, Filamentus, Siphonaceous and Parenchymatous.
4. **Reproduction:** Vegetative, Asexual and Sexual.
5. **Classification** -G. M. Smith (1955) up to classes.
6. **Study of life cycle** w.r.t. Systematic position, thallus structure and reproduction of
   a) *Nostoc* and
   b) *Chara.*
7. **Economic importance** w.r.t. Agriculture, Industries, Medicine and Energy production.

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UNIT – III: **(12 Periods)**

Fungi

1. **General Characters.**
2. **Thallus structure.**
3. **Mode of nutrition** (Parasites, Saprophytes and Symbionts).
4. **Reproduction:** Vegetative, Asexual and Sexual.
5. **Classification of Fungi** - according to G. Ainsworth (1973) upto classes.
6. **Study of life cycle** w. r. t. Systematic position, thallus structure reproduction of
   a) *Mucor* and
   b) *Puccinia.*
7. **Economic importance** w. r. t. Agriculture, Industries, Food and Medicine.

UNIT – IV **(12 Periods)**

1. **Lichens:**
   a) **Definition and General Characters.**
   b) **Types** - Crustose, Foliose and Fruticose.
   c) **Ecological importance and Economical importance** w.r.t. Agriculture, Industries, Food and Medicine.

2. **Plant Pathology:**
   a) **Classification of plant diseases based on pathogens** (viral, bacterial and fungal).
   b) **Plant diseases caused by –**
      i. **Viruses-**w.r.t. Leaf curl of Papaya (Symptoms, Causal organism and Control measures).
      ii. **Bacterial-** Bacterial blight of cotton (Symptoms, Causal organism and Control measures).
      iii. **Fungal-** Red rot of Sugarcane (Symptoms, Causal organism- *Colletotrichum falcatum* and Control measures).

- **Note: Developmental stages not expected.**

Note: Student activates like seminars, quiz, debate, assignments, field work, study Project and models etc. are part of curriculum for all units.

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SEMESTER – I

Paper – II

Plant Diversity- II

(Bryophyta, Pteridophyta, Gymnosperm and Paleobotany)

(48 Periods)

UNIT – I **(12 Periods)**

Bryophyta

1. **General characteristics** w.r.t. Habit, Habitat, Gametophytes, Reproduction and Sporophyte.
2. **Adaptations to land habit.**
3. **Range of thallus organization** w.r.t. Morphology and Anatomy.
4. **Classification as per G. M. Smith** (up to order).
5. **Morphology, reproduction and life cycle of following type.**
   a) ***Riccia*** (Hepaticopsida) and
   b) ***Funaria*** (Bryopsida)
6. **Economic importance** w.r.t. Formation of peat, Packing material, Bedding stock, Medicines, in experimental botany, Food and Source of fuel.

UNIT – II **(12 Periods)**

Pteridophytes

1. **General characteristics** w.r.t. Habit, Habitat, Sporophyte and Reproduction.
2. **Classification of Pteridophytes** according to **G. M. Smith (1955)** upto classes.
3. **Study of early land plant- *Rhynia*** w.r.t. Systematic position and Morphology.
4. **Morphology, anatomy, reproduction and life cycle of following type.**
   a) ***Equisetum*** and
   b) ***Marsilea***
5. **Types of stele.**
6. **Ecological and Economical importance** w.r.t. Food, Soil binding, Scouring, Nitrogen fixation, Medicines, Ornamentals etc.

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B.Sc. SEMESTER – III

Paper – I

(48 Periods)

Reproductive Biology of Angiosperms, Plant Growth and Development

UNIT – I: **(12 Periods)**

1. Structure of Stamen, Microsporogenesis and Male gametophyte.
2. Structure of Pistil, Megasporogenesis and Female gametophyte (*Polygonum* type).
3. Types of Embryo sac (Mono, bi and tetrasporic).
4. Structure and types of Ovules.
5. Pollination: Types, Contrivances of self and cross pollinations, Attractions and Rewards.

UNIT – II: **(12 Periods)**

1. **Double fertilization and Triple fusion**
2. **Seed:**Endosperm and its types, Embryo and its types, Development of Dicot embryo (Onagrad type).
3. **Significance of seed:** Ecological adaptations
   Seed dormancy: Suspended animation, causes and role of dormancy, methods to break seed dormancy.
   Seed dispersal strategies.

UNIT – III **(12 Periods)**

1. **Growth and Development:Definition, phases of growth and development.**
2. **Plant Growth Regulators:** Introduction and Role of Auxin, Cytokinin, Gibberelin, Abscisic acid and Ethylene
3. **Plant Movements:** Tropic and Nastic Movements.

UNIT – IV: **(12 Periods)**

1. **Photoperiodism:** Concept, Short-day plants, Long-day plants, Day-neutral plants.
2. **Physiology of flowering:** Concept of florigen, Vernalization.
3. **Phytochromes:** Pr and Pfr forms, Circadian rhythm (Biological clock) Process and significance.
4. **Senescence and Abscission:** Definition and general account.

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Botany

B.Sc. SEMESTER – III
Paper – II
(48 Periods)
Plant Biochemistry and Physiology

UNIT – I: **(12 Periods)**

1. Carbohydrates: Definition, properties and role, Aldoses and Ketoses; Structure of monosaccharides (glucose), disaccharides (sucrose), polysaccharides (cellulose and starch).
2. Lipid: Definition, properties and role; structure and uses of fatty acids, oils and waxes, phospholipids, sphingolipids, sterols.
3. Proteins: Structure and classification of amino acids, peptide bond and primary structure of protein.

UNIT – II: **(12 Periods)**

1. **Basics of Enzymology:** Nomenclature (IUB system), Characteristics and properties of enzymes, Holoenzyme, Apo-enzyme, Co-enzyme and Co-factors, Regulation of Enzyme Activity (Enzyme-Substrate Complex Theory), Mechanism of Action (Lock and Key Model, Induced Fit Model).
2. Nitrogen Metabolism: Sources of Nitrogen to plants, Biological Nitrogen Fixation (Mechanism of Root Nodule formation), Importance of Nitrate Reductase.
3. Mineral Nutrition: Role and deficiency symptoms of macro (N, P, K, S, Ca, Mg) and micro (Cu, Fe, Zn, Mn, Mo) –nutrients.

UNIT – III: **(12 Periods)**

1. **Plant Water Relations:** Properties of water, diffusion, osmosis and plasmolysis, water potential.
2. **Ascent of sap:** Water conduction through xylem, Root pressure theory, Cohesion-Adhesion theory.
3. **Transpiration:** Definition, types, Stomatal opening and closing mechanisms(K and malate theory), significance, guttation.
4. **Phloem transport:** Bulk flow theory (Munch hypothesis).
5. Theories of absorption of solute in plants:Active absorption (Carrier concept), Passive absorption (Ion exchange theory and Donnan Equilibrium theory).

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Scheme for Choice Based Credit System for B.Sc. Programme in

BOTANY

Semester	Core Course 6 Credits	Ability Enhancement Compulsory Course (2+2= 4 credits)	Skill Enhancement Courses SEC 2 Credits	Discipline Specific Elective DSE 6 Credits
SEM-V			**SEC-III** Any One SEC is to be chosen from the pool of SEC of Core Subjects selected by the student 1. Gardener Training – (Basic) 2. Mushroom Culture Technology 3. Herbal Technology 4. High Density Planting 5. Floriculture **PRACTICAL** (70% part of the SEC is Practical)	**DSE I** Two papers of any one DSE are to be chosen by the student from Three Options given below. Option-1 Paper-I : Genetics and Plant Breeding – I Paper II: Genetics and Plant Breeding - II Option-2 Paper-I: Molecular Biology - I Paper II: Molecular Biology - II Option-3 Paper-I: Economic Botany- I Paper II: Economic Botany- II **PRACTICAL** Based on paper I and II of DSE selected by the student from the above mentioned Options-1, 2 and 3 of Semester-V

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B.Sc.
Botany

SEMESTER – V:

Discipline Specific Elective-I (DSE-I)

NOTE: Student has to select any ONE from the three Options under DSE-I category.

Papers	Title of the Paper	Theory / Practical	Internal Assessment	Total Marks
Option-1				
Paper – I	Genetics and Plant Breeding – I	50 Marks	10 Marks	60 Marks
Paper - II	Genetics and Plant Breeding – II	50 Marks	10 Marks	60 Marks
Option-2				
Paper – I	Molecular Biology - I	50 Marks	10 Marks	60 Marks
Paper -II	Molecular Biology - II	50 Marks	10 Marks	60 Marks
Option-3				
Paper –I	Economic Botany- I	50 Marks	10 Marks	60 Marks
Paper –II	Economic Botany- II	50 Marks	10 Marks	60 Marks
Practical – V	Based on two papers of DSE – I selected by the student from the above mentioned Options- 1, 2 and 3 of Semester –V	30 Marks	--	30 Marks

Internal Assessment:
Based on Assignment, Seminar, Unit Test & Overall Attendance and Performance of the Student.

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2. Types of sadhetu
3. Types of Hetvabhas
4. Vyptigrahopaya

Foundation Course
Philosophy
SEMESTER II
Western Logic

UNIT I

1. Nature,Scope, Definition of Western Logic
   25 Marks
2. Classification of term
3. Classification of Proposition
4. Cannotation and denotation

UNIT II

1. Quantitative and Quatitative propostion
   25 Marks
2. Square of opposition of proposition
3. Conversion
4. Obsersion

B.A.Sociology (CBCS)

1-Indian Society

Semester - II

Foundation Course

I. Sociological pesspeetines of the study of Indian Society.

A) Marxist Perspective

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B) Stsuctural-functional Perspection
C) Subttern perspective
D) Indological perspective

II. **The Composition of Indian Society.**

A) Tribal Community
B) Rural Community
C) Urban Community

III. **Racial, Religious and Linguistic Composition of Indian Society.**

A) Population of India
B) Racial Composition
C) Religious composition
D) Linguistic Composition

IV. **Unity and divessity in Indian Society.**

A) Diversity in Indian Society
- Raial, Religious, Linguistic and Cultural

B) Unity in Indian Society
Geopraphical, political, Language, Cultural, Religious.

B.A.Sociology (CBCS)

2-Social Problem

Semester - II

Foundation Course

I. A) Fallacies about social Problems.

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Semester – I

- **Unit – I - Understanding Sociology .**
  - The origin and development of Sociology
  - Definition of Sociology
  - Sociology as a Science
  - Nature & Scope of Sociology
  - Subject matter of Sociology
  - Sociology & its relationship with political Science and Economics
  - Importance of Sociology
- **Unit – II - Basic Concepts**
  - Society – Meaning and characteristics
  - Social Group – meaning & Characteristics of Social group
  - Types of Social group – Primary group, Secondary group
  - Characteristics & Importance of Primary & Secondary group
  - Merton's theory of Reference group
  - Social Structure – Meaning and elements of Social Structure
  - Social Status – Meaning and types.
- **Unit – III - Institutions**
  - Meaning and Characteristics
  - Family – Definition, characteristics, types, recent Changes in the Functions of Family
  - Marriage – Meaning, Aims of marriage, Characteristics, types of marriage, Changing nature of marriage.
  - Religion – Meaning & basic Characteristics, Functions of religion.
- **Unit – IV – Culture and Socialization**
  - Definition
  - Types of Culture
  - Characteristics of culture
  - Elements of Culture
  - Socialization - meaning of Socialization –Aims of Socialization
  - Stages of Socialization
  - Agencies of Socialization
  - Importance of Socialization

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M.Sc. Part I Semester –I Zoology

Paper – Medical Laboratory Techniques (01MSCZ004)

NEP-2020 (Major Elective) Credits-3 Marks - 80

Unit-I **(15 Hrs)**

1.1 Basic Laboratory Principles - Code of Conduct of Medical Laboratory Personnel.

1.2 Organization and Functioning of Clinical Laboratory.

1.3 Hazards in the Laboratory (Chemical Hazards, Clinical Hazards, Electrical Hazards, Biological Hazards. Waste Disposal.

1.4 Safety Measures - Safety Equipment's, Safety Symbols.

Unit-II **(15 Hrs)**

2.1 Introduction of Common Laboratory Equipment's: Hot Air Oven, Incubator, Autoclave, Water Bath and Centrifuge, Ultra-centrifuge

2.2 Microscope- Fundamentals of Microscopy, Resolution and Magnification, Light Microscopy,

2.3 Electron Microscopy- Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM).

2.4 Polymerase Chain Reaction Machine (Thermal Cycler) and Process of PCR, Polyacrylamide Gel Electrophoresis (PAGE) and UV-Trans-Illuminator.

Unit-III **(15 Hrs)**

3.1 Specimen Collection, Processing and Analytical Techniques Collection and Preservation of Blood

3.2 Urine, Stool, Sputum, Pus, Body Fluids and Swab.

3.3 Preparation of Blood Smears.

3.4 Sources of Biological Variations and Pre-Analytical Variables.

Unit-IV **(15 Hrs)**

4.1 Preparation of Reagents: Buffers , Normal, Percent and Molar Solution, Normal Saline -Methods of Measuring Liquids.

4.2 Clinical Laboratory Records - Modern Laboratory Set Up - Quality Control: Accuracy, Precision, and Reference Values.

4.3 Disposal of Biomedical Waste

4.4 Laboratory Safety Protocols and Guidelines

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M.Sc. Part I Semester –II Zoology
Paper-VIII, Economic Zoology (02MSCZ004)

NEP-2020 (Major Elective) Credits-3 Marks - 80

Unit-I Live Stock Management: **(15 Hrs)**

1.1 Dairy: Introduction to common dairy animals and techniques of dairy management

1.2 Types, loose housing system and conventional barn system; advantages and limitations of dairy farming

1.3 Establishment of dairy farm and choosing suitable dairy animals-cattle Cattle feeds, milk and milk products, Cattle diseases

1.4 Poultry: Types of breeds and their rearing methods, Feed formulations for chicks, Nutritive value of egg and meat , Disease of poultry and control measures

Unit-II Aquaculture: **(15 Hrs)**

2.1 Aquaculture in India: An overview and present status and scope of aquaculture

2.2Types of aquaculture: Pond culture: Construction, maintenance and management; carp culture, shrimp culture, shellfish culture, composite fish culture and pearl culture

2.3 Prawn culture: Culture of fresh and marine water prawns. Preparation of farm.

2.4 Preservation and processing of prawn, export of prawn.

Unit-III Fish culture: **(15 Hrs)**

3.1 Common fishes used for culture.Fishing crafts and gears.

3.2 Ornamental fish culture: Fresh water ornamental fishes- biology, breeding techniques

3.3 Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality.

3.4 Modern techniques of fish seed production. Control of snail and algal growth.

Unit-IV Vermiculture: **(15 Hrs)**

4.1 Scope of vermiculture. Types of earthworms.

4.2 Habit categories - epigeic, endogeic and anecic; indigenous and exotic species.

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Basket for the 2 year PG Program (M.Sc. Mathematics) under NEP-2020

	Sem - I	Sem - II
Major (DSC)	• Advanced Abstract Algebra • Topology • Linear Algebra	• Field theory • Measure theory • Classical Mechanics
Major Elective (DSE)	• Numerical Analysis • Real Analysis • Ordinary differential Equations • Calculus of Variations • Number Theory • SCILAB Programming • Fuzzy Mathematics • Logic and Set Theory • Elementary Discrete Mathematics	• Operations Research • Differential Geometry • Combinatorics • Graph Theory • Coding Theory • Cryptography • Advanced Topics in Topology • Statistics and Probability • C Programming • Financial Mathematics
Research Methodology/OJT/ Field Project	Research Methodology	OJT/Field Project

Note:

1. Students need to do OJT/Field Project as per NEP guidelines and mentors shall be designated by department/colleges for internship/OJT.
2. Maximum 10 students per teacher shall be allocated for mentorship of OJT/Field Project.
3. The students must complete on-the-job training/internship of 04 credits during summer break, after completion of the second semester of the first year in the respective Major Subject.
4. The assessment of OJT/FP shall be conducted by the Department.
5. Teachers may use software's, if required for teaching contents of a course.
6. SCILAB Programming and C Programming are 4 credit courses, where 2 Theory and 2 practicals per week shall be devoted to them.
7. Term end Theory examination of 80 marks and 20 marks internal assessment shall be conducted for those courses which have theory and practical components.

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2 year PG Program structure under NEP-20 to be implemented from Academic year 2023-24

	Sem - I	Sem - II
Major (DSC) 4 credits per course	4 x 3	4 x 3
Major Elective (DSE) 4 credits per course	4 x 1	4 x 1
Research Methodology/ OJT/Field Project 4 credits per course	4 x 1	4 x 1
Total Credits	**20**	**20**

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Master of Arts (NEP 2020)

M.A History

Examination Scheme

SEMESTER – II

	Major Papers		Examinations Scheme		Internal Assessment	Total	
			Marks	Credits	Marks	Marks	Credits
Major (DSC) Paper – I (Mandatory)	Trends and Theories in History	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
Major (DSC) Paper – II (Mandatory)	India Under British Rule : 1857-1905	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
Major (DSC) Paper – III(Mandatory)	Contemporary World :1950-2000	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
Major (DSE) Elective Paper – IV	Independent India: 1947-2000	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
	State, Society and Culture of India 300 B.C.-500 A.D.	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
	Society Economy and Culture Under the Sultans	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
	Society Economy and Culture Under the Mughals	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
	History of Art and Architecture in India: Medieval Period	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
	Nineteenth Century Maharashtra	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
Minor (OJT) / Field Work – V		Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
Total		Full Marks	400	20	100	500	20
		Pass Marks	160		40	200	

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Syllabus
Gondwana University, Gadchiroli
History
P.G. Program
Sem – II
Major (DSC)- Four (4) Credit
Trends and Theories of History

Theory Mark:80 Code S2 MAHIS 01 Internal Assessment marks: 20
Total Marks:-100

Course Outcome

1.Historiographical literacy. -Students will be able to identify and describe the contours and stakes of conversation among historians within defined historiographical fields.

2. Students will understand philosophical base of History.

3.Students will be able to explain and critique the historical schools of thought that have shaped scholarly understanding of their fields of study.

Unit 1

a. Orientalist History Writing – William Jones, James Princep

b. Imperialist History Writing – J.S.Mill , William Hunter

c. Nationalist History Writing – K.P.Jayaswal, Mohammad Habib

Unit 2

a. Marxist History Writing – R.S.Sharma, D.D.Kosambi

b. Subaltern – Ranjit Guha, Sumit Sarkar

c. Post- Modern – Jean Lyotard,Frederick Jamseon

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New Education Policy Syllabus 2023

FYPGP -History

M.A. Sem I

Major (DSC)- Four (4) Credit

1.Historiography

2.India Under Company's Rule: 1757-1856

3. Modern World: 1914 to 1950

Major Elective (DSE)- Four (4) Credit

1. Indian National Movement: 1905 – 1947
2. India under the Sultanate Period
3. India Under the Mughals
4. History of India up TO 300 B.C.
5. History of Art and Architecture in India: Ancient Period
6. Socio-Religious Movements in Maharashtra, 1200 To 1700 A.D

Minor (RM)- Four (4) Credit

1. RESEARCH METHODOLOGY IN HISTORY

M.A. Sem – II

Major (DSC)- Four (4) Credit

1. Trends and Theories of History
2. India under British Rule: 1857 – 1905
3. Contemporary World: 1950 to 2000

Major Elective (DSE)- Four (4) Credit

1. Independent India: 1947-2000
2. State, Society and Culture of India, 300 B.C.–500 A.D.
3. Society, Economy and Culture Under the Sultans
4. Society, Economy and Culture Under the Mughals
5. History of Art and Architecture in India: Medieval Period
6. Nineteenth Century Maharashtra

OJT (On Job Training) - Four (4) Credit

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Master of Arts (NEP 2020)

M.A History

Examination Scheme

SEMESTER – II

	Major Papers		Examinations Scheme		Internal Assessment	Total	
			Marks	Credits	Marks	Marks	Credits
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		Pass Marks	32		08	40	
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		Pass Marks	32		08	40	
	Society Economy and Culture Under the Sultans	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
	Society Economy and Culture Under the Mughals	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
	History of Art and Architecture in India: Medieval Period	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
	Nineteenth Century Maharashtra	Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
Minor (OJT) / Field Work – V		Full Marks	80	04	20	100	04
		Pass Marks	32		08	40	
Total		Full Marks	400	20	100	500	20
		Pass Marks	160		40	200	

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Laboratory Exercises/ Field Exercises (Any 12):

1. Tissue systems, meristem, vascular and cork cambium
2. Internal structure of root, stem and leaf (dicot and monocot), advanced secondary growth in dicot stem and root.
3. Anomalies in primary and secondary structure of stem
4. Study of living shoot apices by dissections using aquatic plants such as *Ceratophyllum*and *Hydrilla*.
5. Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double-stained permanent slides of a suitable plant such as *Coleus, Kalanchoe, Tobacco.* Examination of shoot apices in a monocotyledon in both T.S. and L.S. to show the origin and arrangement of leaf primordia.
6. Study of alternate and distichous, alternate and superposed, opposite and superposed; opposite and decussate leaf arrangement.
7. Examination of rosette plants (*Launaea, Mollugo, Raphanus, Hyoscyamus*etc) and induction of bolting under natural conditions as well as by GA treatment.
8. Microscopic examination of vertical sections of leaves such as *Cleome, Nerium,* Maize and Wheat to understand the internal structure of leaf tissues and trichomes, glands etc. Also study the C3 and C4 leaf anatomy of plant.
9. Study of epidermal peels of leaves such as *Coccinia, Gaillardia, Tradescantia, Thunbergia,* etc. to study the development and finalstructure of stomata and prepare stomatal index. Demonstration of the effect of ABA on stomatal closure.
10. Study of whole roots in monocots and dicots. Examination of L.S. of root.from permanent preparation to understand the organization of root apical meristem and its derivatives. (use maize, aerial roots of banyan, Pistia, Jussieua etc.). Origin of lateral roots.Study of leguminous roots with different types of nodules.
11. Study of microsporogenesis and gametogenesis in sections of anthers.
12. Examination of modes of anther dehiscence and collection of pollen grains for microscopic examination (Maize, Grasses, *Crotolaria, Tradescantia, Brassica, Petunia, Solanum melongena*, etc.)
13. Tests for pollen viability using stains and *in vitro* germination. Pollen germination using hanging drop and sitting drop cultures, suspension culture and surface culture.
14. Estimating percentage and average pollen tube length *in vitro.*
15. Role of transcription and translation inhibitors on pollen germination and pollen tube growth.
16. Pollen-pistil interaction, self-incompatibility, *in vitro* pollination.
17. Study of ovules in cleared preparations; study of monosporic, bisporic and tetrasporictypes of embryo sac development through examination of permanent stained serial sections.
18. Field study of several types of flower with different pollination mechanisms (wind pollination, thrips pollination, bee/butterfly pollination, bird pollination).
19. Emasculation, bagging and hand pollination to study pollen germination, seed set and fruit development using self compatible and obligate outcrossing systems. Study of cleistogamous flowers and their adaptations.
20. Study of nuclear and cellular endosperm through dissections and staining.
21. Isolation of zygotic globular, heart-shaped, torpedo stage and mature embryos from suitable seeds and polyembryony in citrus, jamun (*Syzygiumcumini*) etc. by dissections.
22. Study of seed dormancy and methods to break dormancy.

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