

સાચી સીક બોર્ડના ઠા. ૦૭/૦૩/૨૦૧૯  
ગાભા: ૨૭૨ પાસા: ૨૨૨

સા. ૨૭૨  
પા. ૨૨૨

Proposed Syllabus for

## M. Phil. and Ph.D. (Biosciences) Course Work

CHOICE BASED CREDIT SYSTEM (CBCS)

w.e.f. June 2019



Department of Biosciences  
Veer Narmad South Gujarat University, Surat

**M. Phil. and Ph.D. (Biosciences) Course Work  
Outline and evaluation scheme**

Subject Code	Subject Title	Credit	External Marks	Internal Marks	Total Marks
BIOCW101	Advances in Research Methodology	4	50	50	100
BIOCW102	Advances in Research Techniques	4	50	50	100
BIOCW103ZO	Advances in Zoology	4	50	50	100
BIOCW103BO	Advances in Botany				
BIOCW103MB	Advances in Microbiology				
BIOCW103BT	Advances in Biotechnology				
<b>Total</b>	4 Subjects/Courses	12	150	150	300

**BIOCW101: Advances in Research Methodology**

**Unit 1 Research methodology**

- 1.1 Basic Research Designing, Setting up Objectives of the Study and Hypotheses to be tested
- 1.2 Setting up Experimental Design and Experimental Protocol
- 1.3 Setting up detailed methodologies, sampling methods, Strategies for execution of the protocols
- 1.4 Designing protocol for statistical validation.

**Unit 2 Research data collection and management**

- 2.1 Scientific literature collection: Types of research literature, Sources
- 2.2 Documentation of collected literature, Reference Index, Database generation
- 2.3 Basics of Bibliographic Citations, Different Bibliographic styles; Recording and managing information, Research information system, Research Ethics and Plagiarisms
- 2.4 Computer and information technology in research, online tools and MOOCs etc.

**Unit 3 Research Communication Skill**

- 3.1 Professional English for life sciences
- 3.2 Writing a literature review and research paper, Writing an abstract, preparing table and figure,
- 3.3 Writing a Ph.D. thesis,
- 3.4 Delivering an effective Oral presentation and Poster preparation & scientific networking

**Unit 4 Professional practices**

- 4.1 IPR and Innovation,
- 4.2 Entrepreneurship: Lab to Land
- 4.3 GLP, NABL and Validation
- 4.4 Biosafety

**BIOCW102: Advances in Research Techniques**

**Unit 1 Instrumentation**

- 1.1 Microscopy: Basics microscopy, Electron microscopy and advanced specialized microscopy
- 1.2 Separation techniques
- 1.3 Atomic and molecular electronic spectroscopy, Vibrational spectroscopy
- 1.4 Chromatography: Paper chromatography, Thin Layer chromatography, HPLC, HPTLC. Preparative techniques, mobile phase selection, Stationary Phase, GC, LC, Mass Spectroscopy)

**Unit 2 Molecular techniques**

- 2.1 Structure determination: Nuclear Magnetic Resonance Spectroscopy (NMR), X-Ray crystallography and Cryo-EM
- 2.2 Tools for genomics and proteomics: Agarose gel, PAGE, 2D PAGE DNA Sequencing, Protein Sequencing, MALDI and SALDI TOF Mass Spectrometry etc.
- 2.3 Immunochemical Techniques: ELISA, RIA, flow cytometry etc.
- 2.4 CRISPR-Cas9 and RNAi biology

**Unit 3 Bionanotechnology, Bioinformatics and Biostatistics**

- 3.1 Concept of bionanotechnology, Formulation of various nanomaterials, Tools and techniques in nanotechnology, Application in Health, environment and agriculture
- 3.2 Bioinformatics resources, Biological databases, Sequence alignments, Bioinformatics techniques for nucleic acid and protein data analysis
- 3.3 Theoretical Concepts and application of Biostatistics in research
- 3.4 Computational Data processing and research problem solving through Biostatistics

**Unit 4 SWAYM MOOC: Environment Natural resources and Sustainable Development**

(URL: <https://swayam.gov.in/courses/3911-environment-natural-resources-and-sustainable-development>)  
Research student has to enrolled and complete the above online course and evaluation can be done by online portal or by the department.

**BIOCW103ZO: Advances in Zoology**

**Unit 1: Embryology and Toxicology**

- 1.1 Embryo development, embryonic stem cells, Infertility, reasons and treatment
- 1.2 Reproductive disorders (Menstrual, Fertility & Pregnancy disorders), advanced techniques: IVF, risk in IVF, Designer baby, Ethics; Regulatory laws & guidelines
- 1.3 Principles of Toxicology: Classes of toxicants, Evaluating dose response relationship, Route of exposure & animal toxicity test: Short term & long term test, Mechanisms of toxicity
- 1.4 Introduction to OECD guide lines & OECD Section-2: Effects on Biotic System

**Unit 2 Environment and Animal Genetics**

- 2.1 Global Environmental problems and impact of environment and ecosystem, Anthropogenic innervations, Conservation of diversity
- 2.2 Biological Diversity Act, Environment protection acts, wild life protection act, EIA
- 2.3 Impact of GM crops on biodiversity, Functional of international Union for the protection of new variety of plant (UPOV)
- 2.4 Animal breeding, out- and in-breeding, open nucleus system, concept of production of specific pathogen free and germ free laboratory (SPF) animal, vaccine production using SPF animals,

**Unit 3: Animal Biotechnology**

- 3.1 Applications of animal tissue culture, Types of animal tissue culture: Adherent & Suspension tissue culture, Short term & long term Tissue culture, Cell culture environment, Cell proliferation & differentiation, Cell adherent molecules
- 3.2 Primary culture, subculture & maintenance of cell line, Culture media, cloning of animal cells: Introduction of DNA in mammalian cell, Stem cell culture, 3D culture
- 3.3 Applied Zoology: Apiculture, Sericulture, Agricultural entomology and Poultry
- 3.4 Animal technology: Organic fertiliser, Panchagavya, vermicomposting, poultry manure,

**Unit 4: Active Learning module**

- 4.1 Study of review on: Contemporary development in animal science/ zoology
- 4.2 Study on new methodology research paper
- 4.3 Field visit / academic tour
- 4.4 Brain storming on relevant topic

**BIOCW103BO: Advances in Botany**

**Unit 1: Plant Growth and PGPR**

- 1.1 Long distance transport, Nitrogen and sulphur, Overview of Biosynthesis of hormones and Elicitor Molecules, Signal Perception and Transduction
- 1.2 Reproductive development, Senescence and Programmed cell Death
- 1.3 PGPR, Biofertilizer, Biopesticides
- 1.4 Plantation and Processing of crops, spices, medicinal and aromatic plants

**Unit 2: Advances Plant Physiology**

- 2.1 Responses to Abiotic and biotic Stresses i.e. Plant Pathogen, and Genetic basis of Plant-pathogen interactions, Control of plant pathogens by genetic engineering
- 2.2 Plant defence systems, Root exude, its Biochemistry and Hydroponics

- 2.3 The molecular physiology of micronutrient acquisition and transport
- 2.4 Plant responses to mineral toxicity

**Unit 3: Plant and Agriculture Biotechnology**

- 3.1 Gene flow in plant: Development of Mapping population- Marker assisted selection (MAS), Screening and validation, Trait related markers and characterization of gene involved, QTL mapping, Gene Pyramiding
- 3.2 Marker assisted breeding for various traits, for ground and background selection, gene introgression, Non-gel based techniques for genotyping
- 3.3 Shoot culture, somatic embryos, artificial seeds, Anther culture and di-haploids
- 3.4 Protoplast culture, Protoplast fusion and somatic hybridization, direct transformation of Protoplast using PEG, electroporation, Particle bombardment, Ti plasmid based transformation

**Unit 4: Active Learning module**

- 4.1 Study of review on contemporary development in plant science
- 4.2 Study on new methodology (research paper)
- 4.3 Field visit / academic tour
- 4.4 Brain storming on relevant topic

**BIOCW103MB: Advances in Microbiology**

**Unit 1 Advances in Microbial Taxonomy, Physiology and Genetics**

- 1.1 Advances in taxonomy
- 1.2 Advances in microbial physiology
- 1.3 Extremophiles
- 1.4 Advances in microbial genetics

**Unit 2 New Approaches in Microbiology**

- 2.1 Omics integrated microbiology: Concept, tool and application
- 2.2 Metabolomics, system biology and synthetic biology
- 2.3 Applied microbiology: Food, Dairy, Agricultural etc.
- 2.4 Advances in medical microbiology: Antimicrobial resistance, Novel antibiotics, emerging and reemerging of new pathogens ETC.

**Unit 3 Microbial Biotechnology**

- 3.1 Pharmaceutical biotechnology
- 3.2 Enzyme and Microbial technology
- 3.3 Microbial production of recombinant products
- 3.4 Environmental microbiology and biotechnology

**Unit 4: Active Learning module**

- 4.1 Study of review on: Contemporary development in Microbiology
- 4.2 Study on new methodology research paper
- 4.3 Field visit / academic tour
- 4.4 Brain storming on relevant topic

**BIOCW103BT: Advances in Biotechnology**

**Unit 1: Animal Biotechnology**

- 1.1 Applications of animal tissue culture, Types of animal tissue culture: Adherent & Suspension tissue culture, Short term & long term Tissue culture, Cell culture environment, Cell proliferation & differentiation, Cell adherent molecules
- 1.2 Primary culture, subculture & maintenance of cell line, Culture media, Cloning of animal cells: Introduction of DNA in mammalian cell, Stem cell culture, 3D culture
- 1.3 Applied Zoology: Apiculture, Sericulture, Agricultural entomology and Poultry
- 1.4 Animal technology: Organic fertiliser, Panchagavya, vermicomposting, poultry manure,

**Unit 2: Plant and Agriculture Biotechnology**

- 2.1 Gene flow in plant: Development of Mapping population- Marker assisted selection (MAS), Screening and validation, Trait related markers and characterization of gene involved, QTL mapping, Gene Pyramiding,
- 2.2 Marker assisted breeding for various traits, for ground and background selection, gene introgression and Pyramiding, Non-gel based techniques for genotyping
- 2.3 Shoot culture, somatic embryos, artificial seeds, wide hybridization, Anther culture and di-haploids
- 2.4 Protoplast culture, Protoplast fusion and somatic hybridization, direct transformation of Protoplast using PEG, electroporation, Particle bombardment, Ti plasmid based transformation

**Unit 3: Microbial Biotechnology**

- 3.1 Pharmaceutical biotechnology
- 3.2 Enzyme and Microbial technology
- 3.3 Microbial production of recombinant products
- 3.4 Environmental microbiology and biotechnology

**Unit 4: Active Learning module**

- 4.1 Study of review on: Contemporary development in Biotechnology
- 4.2 Study on new methodology research paper
- 4.3 Field visit / academic tour
- 4.4 Brain storming on relevant topic

\*\*\*