Choice Based Credit System (CBCS)

"Dissemination of Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR

(EMPOWERED AUTONOMOUS)

(Affiliated to Shivaji University Kolhapur)

NAAC Reaccredited: “A” with CGPA 3.24

Revised Syllabus for Zoology

B. Sc. Part- III

To be implemented from July 2023 onwards

STRUCTURE OF B.Sc. III SYLLABUS

Sr. No	Paper	Name of Paper	Marks	Internal Assessment (CIE)	Total Marks	Credits
	SEMESTER-V					
	(DSE) Discipline Specific Electives					
1	DSE-1008E1	**Paper IX** Molecular Biology and Biotechniques	70	30	100	4
	DSE-1008E2	**Paper X** Animal Biotechnology				
2	DSE-1008E3	**Paper-XI** Developmental Biology-I	70	30	100	4
	DSE-1008E4	**Paper-XII** Developmental Biology-II				
3	SEC-1008C	Research Methodology				
4	AECC	English	50		50	2
	SEMESTER-VI					
	(DSE) Discipline Specific Electives					
5	DSE-1008F1	**Paper-XIII** Immunology-I	70	30	100	4
	DSE-1008F2	**Paper- XIV** Immunology-II				
6	DSE-1008F3	**Paper-XV** Ecology and Toxicology	70	30	100	4
	DSE-1008F4	**Paper-XVI** Aquatic Biology				
8	SEC-1008D	Sericulture			50	2
9	AECC	English			50	2
10	Practical Paper V	Practicals based on DSE-1008E1 and1008E2			50	2
11	Practical Paper VI	Practicals based on DSE-1008E3 and 1008E4			50	2
12	Practical Paper VII	Practicals based on DSE-1008F1 and 1008 F2			50	2
13	Practical Paper VIII	Practicals based on DSE-1008F3 and 1008 F4			50	2

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ZOOLOGY-DSE-1008E1

Semester: V Zoology-Paper IX

MOLECULAR BIOLOGY AND BIOTECHNIQUES

Theory: 30 Hours - (37.5 lectures of 48 minutes) Credits -02

Unit I: Introduction to molecular biology 12

1. Concept of gene
2. DNA replication in prokaryotes and eukaryotes: Semi-conservative type
3. DNA damage and repair mechanism
4. Transcription in prokaryotes and eukaryotes - Initiation, Elongation and Termination
5. RNA splicing
6. Genetic code and its properties
7. Translation in prokaryotes and eukaryotes –Initiation, Elongation and Termination

Unit II: Biotechniques 18

1. Concept of cloning and cloning vectors: Characteristics & types (plasmid, cosmid, phagemid, lambda, bacteriophage, artificial chromosome)
2. Screening techniques: Replica plating & blue white screening
3. Restriction enzymes: Nomenclature, detailed study of Type II endonucleases
4. Southern, northern and western blotting
5. Polymerase chain reaction
6. DNA finger printing
7. Method of DNA sequencing: Sanger’s method
8. Genomic and c-DNA library

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ZOOLOGY-DSE -1008E2

Semester: V Zoology-Paper X

ANIMAL BIOTECHNOLOGY

Theory: 30 Hours - (37.5 lectures of 48 minutes) Credits -02

Unit I: Genetically modified organisms 12

1. Cloning techniques- Nuclear transplantation
2. Production of transgenic animals- Transformation techniques (calcium chloride method, DNA microinjection, retroviral and electroporation method)
3. Knockout mice- Production & applications
4. Applications of transgenic animals
5. Production of transgenic plants: Agrobacterium mediated transformation.

Unit II: Culture techniques and applications 18

1. Animal cell culture:
    a. Cell culture techniques-Mechanical and chemical disaggregation and types of cell culture (primary, secondary and cell line)
    b) Requirements of animal cell culture-Laboratory design, equipment's used- (CO_2,incubator, phase contrast and fluorescence microscope, laminar Air flow)
    c) Types of media-Natural and artificial media (serum containing, serum free, chemically defined and protein free)
    d) Sterilization technique- Physical and chemical methods
    e) Applications of animal cell culture
2. Stem cell types
3. Gene therapy- Types and applications
4. Recombinant DNA in medicines: Production of recombinant insulin and human growth hormone
5. Application of biotechnology in animal husbandry, medicine and agriculture

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VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

B.Sc. III ZOOLOGY

PRACTICAL-V

(BASED ON PAPER NO IX AND X)

Credits 2

1. Genomic DNA isolation from *E. coli*
2. Plasmid DNA isolation from *E. coli*
3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data provided.
5. Separation of protein by SDS-PAGE
6. Separation of DNA by agarose gel electrophoresis
7. Study the following technique through photograph Southern blotting, Northern blotting, Western blotting, DNA sequencing, PCR, DNA finger printing
8. To study following Instruments.

a) pH meter	b) Spectrophotometer	c) Calorimeter
d) Cooling Centrifuge	e) Laminar air flow	f) CO_2 incubator

9. TLC-Thin layer chromatography
10. Microtechnique (HE, AB/ PAS)
11. Study of DNA by Feulgen technique.
12. Submission of report on cell culture/ techniques in animal biotechnology
13. Visit to tissue culture laboratory and bio-fertilizer industry

SUGGESTED READINGS:

1. Brown, T.A. (1998). *Molecular Biology Labfax II: Gene Cloning and DNA Analysis*.
2. Glick, B.R. and Pasternak, J.J. (2009). *Molecular Biotechnology – Principles and applications of Recombinant DNA*. IV Edition, ASM press, Washington, USA.
3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). *An Introduction to Genetic Analysis*. 9th Edition. Freeman and Co., N.Y., USA.
4. Snustad, D.P. and Simmons, M.J. (2009). *Principles of Genetics.* V Edition, John Wiley and Sons Inc.
5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). *Recombinant DNA Genes and Genomes- A Short Course*. III Edition, Freeman and Co., N.Y., USA.
6. Beauchamp, T.I. and Childress, J.F. (2008). *Principles of Biomedical Ethics.* 6th Edition,
7. Singh B. D. (2010). Biotechnology Expanding Horizons. Kalyani Publishers

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VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

ZOOLOGY-DSE -1008E3

Semester: V Zoology-Paper XI

DEVELOPMENTAL BIOLOGY-I

Theory: 30 Hours - (37. 5 lectures of 48 minutes) Credits -02

UNIT – I: Early embryonic development -I **15**

1. An introduction and scope and importance of developmental biology.
2. Overview of male & female reproductive system in mammal.
3. Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals
4. Structure of mature egg and sperm in amphibia and human.
5. Fertilization: Types - External (amphibians), internal (mammals) and process of fertilization
6. Block to polyspermy- Slow & fast block to polyspermy
7. Types of egg on the basis of distribution & amount of yolk.
8. Cleavage: Definition, types, planes & patterns and significance.

UNIT –II: Early embryonic development in mammals -II **15**

1. Morulation and blastulation
2. Gastrulation: Definition, fate maps, significance of gastrulation.
3. Morphogenetic cell movements- Epiboly and emboly (types of embolic movements).
4. Fate of germ layers
5. Neural tube formation
6. Extra embryonic membrane
7. Placentation in mammals : Definition, types and significance, classification on the basis of morphology and histology and functions of placenta

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VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

ZOOLOGY-DSE -1008E4

Semester: V Zoology-Paper XII

DEVELOPMENTAL BIOLOGY-II

Theory: 30 Hours - (37. 5 lectures of 48 minutes) Credits -02

UNIT – I: Fundamental processes in development 15

1. Fundamental processes in development (brief idea)- Gene activation, specification (autonomous, conditional, syncytial), determination, competence, differentiation (concept of dedifferentiation, re-differentiation, trans-differentiation), commitment
2. Morphogens-Concept & properties of morphogen
3. Regeneration (w.r.t. Lizard), senescence, ageing and concept of apoptosis.
4. Intercellular communication – Autocrine, paracrine, juxtracrine
5. Applications of developmental biology in medicine and research.
6. Medical implication in developmental biology – Genetic disorder in human development

UNIT- II: Chick Embryology 15

1. Structure of sperm
2. Structure of egg and vitellogenesis
3. Fertilization and cleavage
4. Blastula and its fate map
5. Process of gastrulation
6. Organizer (Development of eye)
7. Organogenesis
   a. Development of neural tube and brain up to 72 hours of incubation
   b. Development of gut up to 72 hours of incubation
   c. Development of blood and heart up to 72 hours of incubation
8. Foetal membranes and significance

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B.Sc. III ZOOLOGY

PRACTICAL-VI

(BASED ON PAPER NO XI AND XII)

Credits 2

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1. Study of developmental stages of frog (permanent slides/microphotographs)
    a. Cleavage
    b. Blastulation
    c. Gastrulation
    d. Neurulation
2. Stages of metamorphosis in frog (permanent slides /microphotographs/specimen)
    a. External gill stage
    b. Internal gill stage
    c. Forelimb stage
    d. Hind limb stage
    e. Tail bud stage
    f. Juvenile stage
3. Study of chick embryo (permanent slides /microphotographs)
    a. Whole mount of chick embryo – 18, 24, 33, 48 and 72 hours.
    b. T.S. of chick embryo – 18, 24, 33, 48 and 72 hours.
4. Preparation of whole mount chick embryo
5. Study of histological structures of placenta (permanent slide or microphotographs)
    a. Epitheliochorial
    b. Endotheliochorial
    c. Hemochorial
    d. Syndesmochorial
    e. Hemoendothelial
6. Examination of gametes- Frog or rat sperm & ovum (permanent slides/microphotographs)
7. Demonstration of culture of early chick embryo in vitro
8. Drosophila culture: Cultivation, maintenance
9. Study of larval developmental stages in *Drosophilla*
10. Identification of fish developmental stages- Egg, larva, juvenile (fry, fingerlings and adult)
11. Preparation of histological slides –Ovaries/ testes

12. Histology of male accessory reproductive glands in human - Prostate gland, bulbourethral glands (permanent slides/microphotographs)

SUGGESTED READINGS:

1. Jonathan M. W. Slack (2012). Essential Developmental Biology, 3rd Edition, Willey Blackwell Publishing.
2. Werner A. Müller (2012). Developmental Biology, Springer; 1997th edition (6 December 2012)
3. Lewis Wolpert, Cheryll Tickle, and Alfonso Martinez Arias (2019). Principles of Development, 6th Edition, OUP Oxford publisher
4. Gilbert, S. F. (2006). Developmental Biology, 8th Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
5. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
6. Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.
7. Dr. Sastry K.V. and Dr. Shukla Vineeta Developmental Biology. 2nd Edition: Rastogi Publications
8. Wolpert L. (2011). Principles of Development– 4th Edition, Oxford University Press
9. Modern Text Book of Zoology- Invertebrates by R.L. Kotpal, Rastogi Pub,10th Edition, 2013.
10. Balinsky B. I. (1981). An Introduction to Embryology by, CBS College Pub, 5th Edition
11. Jan A. Pechenik (2000). Biology of the Invertebrates, 4th Edition, Tata McGraw- Hill

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VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

ZOOLOGY-DSE -1008F1

Semester: VI Zoology-Paper XIII

IMMUNOLOGY- I

Theory: 30 Hours - (37. 5 lectures of 48 minutes) Credits -02

Unit I: Overview of Immune system 15

1. Introduction to basic concepts in immunology, components of immune system.
2. Types of immunity- Innate immunity (physical, physiological, cellular and cytokine barrier) and adaptive immunity- features of adaptive immunity, active: artificial and natural immunity, passive: artificial and natural immunity.
3. Haematopoiesis
4. Cells in immune system- Lymphoid cells (B lymphocytes, T- lymphocytes), natural killer cells (NK cells), phagocytes, granulocytic cells- neutrophils, eosinophils, basophils, mast cells.
5. Organs of immune system- Primary lymphoid organ- bone marrow, thymus, bursa of fabricius. Secondary lymphoid organ- lymph node, spleen, mucosal associated lymphoid tissue (MALT), tonsils, gut associated lymphoid tissue (GALT)

Unit II: Antigen, Antibody and their interactions 15

1. Antigens**:** Basic properties of antigens
2. Antibodie**s:** Structure, classes and function of antibodies.
3. Antigen-Antibody interactions**:** Cross-reactivity, compliment fixation, precipitation reactions, agglutination reactions, ELISA & its type, immunofluorescence.
4. Hybridoma technology, monoclonal antibodies in therapeutics and diagnosis.

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ZOOLOGY-DSE -1008F2

Semester: VI Zoology-Paper XIV

IMMUNOLOGY- II

Theory: 30 Hours - (37. 5 lectures of 48 minutes) Credits -02

Unit I: Working of the Immune system 15

1. Structure and functions of MHC
2. Exogenous and endogenous pathways of antigen presentation and processing
3. Basic properties of signalling molecules-cytokines and their types (chemokines, interleukins, interferons, lymphokines, tumour necrosis factor)
4. Complement system: Components and pathways (classical & alternative)

Unit II: Immune system in health and disease 15

1. Gell and Coombs' classification and brief description of various types of hypersensitivities
2. Autoimmune disease- Organ-specific autoimmune diseases (insulin-dependent diabetes mellitus, hashimoto's thyroiditis) and systemic autoimmune diseases- (multiple sclerosis, rheumatoid arthritis)
3. Concept of immunodeficiency –Central and peripheral tolerance
4. Vaccines- Properties of vaccines, active and passive immunization. Types of vaccine- attenuated, inactivated, DNA vaccines, toxoids.

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B.Sc. III ZOOLOGY

PRACTICAL-VII

(BASED ON PAPER NO XIII AND XIV)

Credits 2

1. Demonstration of primary lymphoid organs- bone marrow & thymus
2. Demonstration of secondary lymphoid organs- lymph node, spleen, mucosal associated lymphoid tissue (MALT), tonsils, gut associated lymphoid tissue (GALT)
3. Histological study of spleen, thymus and lymph nodes
4. Preparation of stained blood film to study various types white blood cells.
5. Enumeration of total WBC count from a given blood sample.
6. Antigen antibody reaction by double immuno-diffusion method.
7. Antigen-Antibody reactions – Agglutination (Blood group test).
8. Agglutination reactions- Latex agglutination reactions.
9. WIDAL test
10. Direct antiglobulin test (Coomb's test)
11. Performing blood cells isolation from whole blood sample
12. Identification of autoimmune disease through charts.
13. Demonstration of a) ELISA (photograph)
    b) Immunoelectrophoresis (photograph)
14. Project work

SUGGESTED READINGS:

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, 6th Edition. W.H. Freeman and Company.
2. Janeway C. A., Travers P., Walport M. and Shlomchik M. (2005). Immunology: The immune system in health and disease 6th edn. Garland Science Pub.
3. Abbas, A. K. and Litchman A. H. (2003). Cellular and Molecular Immunology, 5th edn., Saunders Publication
4. Abbas, A. K. and Litchman A. H. (2004). Basic Immunology: Functions and disorders of the immune system, 2nd edn.
5. Roitt's Essential Immunology (2006) 11th edn. Blackwell publication.
6. D. Mole, J. Bronstoff, D. Roth, I. Roitt, Mosbey (2006). Immunology 7th International edn. Elsevier publication.

7. C. V. Rao (2002). An Introduction to Immunology Narossa Publishers.
8. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, 7th Edition, Mosby, Elsevier Publication.
9. Kindt T. J., Osborne B. A. and Goldby R. A. (2013) Kuby Immunology, 7th Edition.
10. Delves P., Martin S., Burton D. and Roitt (2011) Essential Immunology (Essentials), 12th Edition.
11. Murphy K. (2011) Janeway & Immunobiology, 8thEdition.
12. Price C. P. and Newman D. J. (1997) Principles and Practiceof Immunoassay, 2nd Sub Edition
13. Hildeman, W.H. (2002) “Essentials of immunology”, Elsevier Scientific. 2002
14. Sites, D.P., Stobo, J.D. and Wells, J.U (1982), “Basic and clinical immunology”, Prentice Hall.

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VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

ZOOLOGY-DSE -1008F3

Semester: VI Zoology-Paper XV

ECOLOGY AND TOXICOLOGY

Theory: 30 Hours - (37.5 lectures of 48 minutes) Credits -02

UNIT I: Ecology **20**

1. Introduction and scope of ecology
2. The structure, function, types ecosystem, abiotic and biotic components,
3. Concept of habitat & niche- niche width and overlap, fundamental & realised niche.
4. Food chain, food web and ecological pyramids,
5. Species interactions-types of interaction (competition, predation, commensalism, parasitism, mutualism, amensalism)
6. Community ecology: Nature of communities, characteristics (species richness, dominance, diversity, abundance), ecotone and edge effect
7. Ecological succession -Types of succession (primary, secondary), stages of succession, mechanisms of succession, types of seres (hydrosere, lithosere)
8. Ecological adaptation in aquatic, desert & terrestrial animals

UNIT II- Toxicology **10**

1. Definition, history, scope & divisions of toxicology.
2. Brief idea of- Dose-effect and dose-response relationship- acute toxicity, sub-acute toxicity, chronic toxicity, organ specific toxicity (neurotoxicity, hepatotoxicity, nephrotoxicity)
3. Heavy metal Toxicity- Mercury, lead, cadmium.
4. Classification of toxic agents- Natural toxins, animal toxins, plant toxins, food toxins, and chemical toxins.

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ZOOLOGY-DSE -1008F4

Semester: VI Zoology-Paper XVI

AQUATIC BIOLOGY

Theory: 30 Hours - (37.5 lectures of 48 minutes) Credits -02

Unit I: Freshwater Biology 20

1. Introduction of the aquatic biomes: Freshwater ecosystem (wetlands, streams and rivers)
2. Origin and classification Ponds & lakes, physico–chemical characteristics: light, temperature stratification, dissolved solids, turbidity; dissolved gases (oxygen, carbon dioxide), nutrient cycling (nitrogen, phosphorus, sulphur, carbon)
3. Streams: Types of streams, physicochemical environment, conservation of streams, adaptation of hill stream fishes
4. Estuaries: Characteristics & types (based on salinity)
5. Eutrophication

UNIT II: Marine Biology 10

1. Introduction of marine ecosystem: Structure & zonation of sea & ocean
2. Physico–chemical properties of seawater- salinity, density, viscosity, surface tension, concept of chlorinity and salinity of sea water.
3. Coral & coral reefs: Types & economic importance
4. Continental shelf, adaptations of deep sea organisms.

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B.Sc. III ZOOLOGY

PRACTICAL-VIII

(BASED ON PAPER NO XV AND XVI)

Credits 2

1. Study of pond ecosystem on field
2. Collection, preservation and identification of zooplanktons.
3. Study of aquatic insects- Photographs/specimens (Any four)
4. Oxygen consumption by any aquatic animal
5. Determine the amount of turbidity/transparency
6. Estimation of dissolved oxygen
7. Estimation of free carbon dioxide
8. Determination alkalinity of given water sample
9. Determination total hardness of given water sample
10. Determination of chloride from given water sample
11. Study of ecological pyramids
12. Study of coral reefs (model)
13. Report on a visit to a Sewage treatment plant/Marine bio reserve/ Fisheries Institutes

SUGGESTED READINGS:

1. Anathakrishnan: Bio resources Ecology 3rd Edition
2. Goldman : Limnology, 2nd Edition
3. Odum and Barrett : Fundamentals of Ecology, 5th Edition
4. Pawlowski: Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
5. Wetzel : Limnology, 3rd edition
6. Trivedi and Goyal : Chemical and biological methods for water pollution studies
7. Welch : Limnology Vols. I-II
8. Dilip Kumar, Rajvaidya (2004). “Environmental Biotechnology”, APH
9. Sharma and Khan (2004).“ Ozone Depletion and Environmental Impacts” , Pointer publishers
10. Pandey Kamleshwar, Shuklar, J. P. & TrivediS. P. (2005). Fundamental of toxicology, New central book agency Pvt. Ltd. Kolkata
11. Walter Dodds and Matt Whiles (2010). Freshwater Ecology -Concepts and Environmental Applications of Limnology 2nd Edition: Academic Press

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ZOOLOGY- SEC- 1008C Semester: V

SKILL ENHANCEMENT COURSES (SEC)

RESEARCH METHODOLOGY

Theory: 30 Hours **Credits -02**

Unit I: Foundations of Research **5**

Meaning, objectives, motivation: research methods vs methodology,

Types of research: analytical vs. descriptive, quantitative vs qualitative, basic vs applied

Unit II: Research Design **8**

Need for research design: features of good design, important concepts related to good design- observation and facts, prediction and explanation, development of models. Developing a research plan: problem identification, experimentation, determining experimental and sample designs

Unit III: Data Collection, Analysis and Report Writing **12**

Observation and collection of data-methods of data collection- sampling methods, data processing and analysis strategies, technical reports and thesis writing, preparation of tables and bibliography. Data presentation using digital technology

Unit IV: Ethical Issues **05**

Intellectual property rights, commercialization, copy right, royalty, patent law, plagiarism, citation, acknowledgement

SUGGESTED READINGS

1. Anthony, M, Graziano, A.M. and Raulin, M.L. (2009). Research Methods: A Process of Inquiry, Allyn and Bacon.
2. Walliman, N. (2011).Research Methods- The Basics. Taylor and Francis, London, NewYork.
3. Wadhera, B.L. (2002). Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, , Universal Law publishing
4. Kothari C.R. (2009). Research Methodology, New Age International.
5. Coley, S.M. and Scheinberg, C.A. (1990). “Proposal writing”. Stage Publications

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VIVEKANAND COLLEGE (EMPOWERED AUTONOMOUS), KOLHAPUR

ZOOLOGY-SEC -1008D SEMESTER: VI

SKILL ENHANCEMENT COURSES (SEC)

Sericulture

Theory: 30 Hours Credits -02

Unit I: Introduction 4

Sericulture: Definition, history and present status; silk route types of silkworms, distribution and races. Exotic and indigenous races mulberry and non-mulberry sericulture

Unit II: Biology of Silkworm 04

Life cycle of *Bombyx mori* structure of silk gland and secretion of silk

Unit III: Rearing of Silkworms 13

Selection of mulberry variety and establishment of mulberry garden rearing house and rearing appliances. Disinfectants: Formalin, bleaching powder, RKO. Silkworm rearing technology: Early age and late age rearing, Types of mountage, spinning, harvesting and storage of cocoons

Unit IV: Pests and Diseases 05

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates, Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial, Control and prevention of pests and diseases

Unit V: Entrepreneurship in Sericulture 4

Prospectus of sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

SUGGESTED READINGS:

1. Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
2. Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
3. Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan1972.
4. Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
5. Silkworm Rearing; Wupang- Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
6. A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.

7. Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.

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VIVEKANAND COLLEGE (EMPOWERED AUTONOMOUS), KOLHAPUR

B. Sc. Programme: Program Outcomes (POs)

Academic year 2022-23

PO1. To acquire the knowledge with facts

PO 2. To acquire the skills in handling scientific instruments.

PO 3. To develop scientific outlook with respect to science subjects.

PO 4. To analyze the given scientific data critically and systematically.

PO 5. To realize ethical moral and social values in personal and social life.

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VIVEKANAND COLLEGE (EMPOWERED AUTONOMOUS), KOLHAPUR

DEPARTMENT OF ZOOLOGY

Program Specific Outcomes (PSOs)

Academic year 2022-23

PSO1. Understand the nature and basic concepts of animal diversity, taxonomy, comparative anatomy, developmental biology, physiology, Biochemistry, genetics and evolutionary Biology

PSO2. Perform procedures as per laboratory standards in the areas of animal diversity, taxonomy, comparative anatomy, developmental biology, physiology, biochemistry, Genetics and evolutionary biology, entomology, sericulture, animal biotechnology, immunology and research methodology

PSO3. Understand the applications of applied zoology in apiculture, aquaculture, agriculture and medical zoology

PSO4. Acquired knowledge about research methodologies and skills of problem solving methods

PSO5. Students will contributes the knowledge for nation building and society

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VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

B. Sc. Part - III Course Outcomes (COs)

Academic year 2022-23

ZOOLOGY – DSE 1008 E1 & DSE 1008 E2: Molecular Biology and Biotechniques and Animal Biotechnology

On the completion of this course student will be able to,

CO1. Understand the concept of gene and central dogma of molecular biology

CO2. Understand the techniques of molecular biology in the field of research

CO3. Compare the genetically modified organisms

CO4. Understand the cell and tissue culture techniques

CO5. Implement cell and tissue culture techniques in laboratory

ZOOLOGY – DSE 1008 E3 & DSE 1008 E4: Developmental Biology I and Developmental Biology II

On the completion of this course student will be able to,

CO1. Memorise structure of reproductive system and neuroendocrine regulation

CO2. Understand the chick embryology

CO3. Interpret the process of early embryonic development in mammals

CO4. Distinguish fundamental process of development

CO5. Describe process of gametogenesis, fertilization; types of cleavage and eggs

ZOOLOGY – DSE 1008 F1 & DSE 1008 F2: Immunology I and Immunology II

On the completion of this course student will be able to,

CO1. Understand the concept of immune system

CO2. Understand the functioning of immune system

CO3. Execute serological testing in laboratory

CO4. Distinguish between immune responses

CO5. Understand the types of hypersensitivity and autoimmune dieses

ZOOLOGY – DSE 1008 F3 & DSE 1008 F4: Ecology &Toxicology and Aquatic biology

On the completion of this course student will be able to,

CO1. Understand basic knowledge about ecology

CO2. Differentiate between toxins and toxic effects

CO3. Understand aquatic biomes and its functioning

CO4. Understand the marine biology and adaptation in marine animals

CO5. Demonstrate the physio-chemical factors of aquatic biomes