Proposed draft Syllabus for B.Sc. III Zoology

Submitted to

Yashavantrao Chavan Institute of Science, Satara
(Autonomous)
Under
Choice Based Credit System (CBCS)
(June 2020-2021)
B.Sc. Part III Zoology

Semester V

Zoology Paper- IX - DSC-301 (COMPARATIVE ANATOMY OF VERTEBRATES)

Zoology Paper- X - DSC-302 (MOLECULAR CELLBIOLOGY AND ANIMAL BIOTECHNOLOGY)

Zoology Paper- XI - DSC-303 (BIOTECHNIQUES AND BIOSTATISTICS)

Zoology Paper- XII- DSC - 304 (AQUATIC BIOLOGY) (A)

(ANIMAL BEHAVIOUR) (B)

(WILD LIFE CONSERVATION AND MANAGEMENT) (C)

DSC 305-

DSC 306 - Comp English

Semester VI

Zoology Paper- XIII- DSE-E30 (DEVELOPMENTAL BIOLOGY OF VERTEBRATES)

Zoology Paper- XIV- DSE-E32 (IMMUNOLOGY)

Zoology Paper- XV- DSE-E31 (APPLIED ZOOLOGY - II)

Zoology Paper- XVI- DSE-F32 (INSECT VECTORS AND HISTOLOGY) (A)

(OCEANOGRAPHY) (B)

(BIOTECHNIQUES) (C)

Rayat Shikshan Sanstha's

Yashwantrao Chavan Institute of Science, Satara

Revised Syllabus for Bachelor of Science

B. Sc. III – Zoology –To be implemented from June 2020

GENERAL OBJECTIVES OF THE COURSE

1) Aims:

1. To impart the knowledge of animal science to thepupils.
2. To make the pupils to use the knowledge in their dailylife.
3. To make the pupils aware of natural resources andenvironment.
4. Application of knowledge in Zoology for nutrition, agriculture & livestock.
5. To provide practical experiences which form a part of their learningprocesses.
6. To develop aptitude for scientific work & ability to pursue studies farbeyond graduation.
7. To encourage the pupils to take life science as a carrier which is the need nowa days.
8. To make the pupils fit for thesociety.

2) Objectives–

1. To impart knowledge is the basic aim of education. The students are expectedto acquire the knowledge of animal science, natural phenomenon, manipulation of nature & environment byman.
2. Understanding the scientific terms, concepts, facts, phenomenon &their interrelationships.
3. Applications of theknowledge.
4. To develop skills in practical work, experiments & laboratorymaterials, instruments.
5. To develop interests in the subject & scientifichobbies.
6. To develop scientific attitude which is the major objective? This makesthe students open minded, critical observations, curiosity, thinkingetc.
7. Abilities to apply scientific methods, collection of scientific data, problemsolving, organize science exhibitions, clubsetc.
8. Appreciation of the subject, contributions of scientists, scientificmethods, scientific programsetc.

3) DURATION

• The course shall be full timecourse.

• The duration of course shall be threeyears.

4) PATTERN: Pattern of Examination will be semester for theory and annual forpractical with INTERNAL ASSESSMENT (Project/Seminar/Field work for theory)Scheme

5) MEDIUM OF INSTRUCTION: The medium of instruction shall be inEnglish.

6) STRUCTURE OF COURSE: B.Sc. III – Zoology THEORY – No. of papers: Eight, Noof practicals: Four SEMESTER V-Paper IX to XII & SEMESTER VI- Paper XIII toXVI

Rayat Shikshan Sanstha's
YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA
(AUTONOMOUS)
Syllabus for B.Sc. Part – III introduced from June, 2020

1.Structure of Syllabus:

Evaluation Structure: B.Sc.III

Semester- V

	ESC	Internal Exam		Total		Practical	Submission			Total
		ISE-I	ISE-II			Exam (Pract+ Oral+ Journal)	Student performance	Semi/ Educational tour	Project (Part-I)/ Literature survey	
Paper IX	40	5	5	50	Practical V	40	5	5	--	50
Paper X	40	5	5	50						
Paper XI	40	5	5	50	Practical VI	40	---	---	10	50
Paper XII	40	5	5	50						
SECC	20	-	-	20		30				30
Total	180	20	20	220	Total	110	5	5	10	130

Semester VI

	ESC	Internal Exam		Total		Practical	Submission			Total
		ISE-I	ISE-II			Exam (Pract+ Oral+ Journal)	Student performance	Semi/ Educational tour	Project (Part-I)/ Literature survey	
Paper XIII	40	5	5	50	Practical VII	40	5	5	--	50
Paper XIV	40	5	5	50						
Paper XV	40	5	5	50	Practical VIII	40	---	---	10	50
Paper XVI	40	5	5	50						
SECC	20	-	-	20		30				30
Total	180	20	20	220	Total	110	5	5	10	130

B.Sc. – III **Semester –III**

Course Structure

B.Sc. -III SEMESTER -V						
Sr. No.	SUBJECT TITLE	PAPER NO	THEORY (TH)		PRACTICAL (PR)	
			No. of Lectures	Credits	No. of Lectures	Credits
1	DSC – IE	IX – XI	9	6	15	6
2	DSC-2E (Elect.)	(Any One among three) XII	3	2	5	2
3	Skill enhancement	I	1	1	3	1
4	AECC-IE	III	2	2	---	---
	TOTAL OF SEM -V		15	11	23	09

B.Sc. -III SEMESTER -VI						
Sr. No.	SUBJECT TITLE	PAPER NO	THEORY (TH)		PRACTICAL (PR)	
			No. of Lectures	Credits	No. of Lectures	Credits
1	DSC – IF (Comp.)	XIII – XIV	9	6	15	6
2	DSC-2F	(Any One among three) XVI	3	2	5	2
3	Skill enhancement	II	1	1	3	1
4	AECC-IF	IV	2	2	---	---

	TOTAL OF SEM -VI		**15**	**11**	**23**	**09**
	TOTAL OF SEM- V & VI		**30**	**22**	**46**	**18**

- **Total marks for B.Sc. Part III including Skill and AECC = 800**
- **Total Credit for B. Sc. – III Semester V & VI = 40**
- **AECC- Ability Enhancement Compulsory Course (IE & IF) – ENGLISH**
- **Skill enhancement course for each subject**

8) SCHEME OF EXAMINATION

Question paper will be set in the view of the / in accordance with the entire syllabus and preferably covering each unit of syllabi.

9) EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAPERS(FOR REVISED SYLLABUS)

Refer copy of revised syllabus

10) OTHERFEATURES

1. Required Books, Journals stated in each syllabus of Part I, Part II and Part III Zoology and Fisheries.

A) LIBRARY: Reference and Text Books, Journals, and Periodicals, Reference Booksfor Advanced Studies.

B) SPECIFIC EQUIPMENTS: Necessary to run the Course (T.V.,L.C.D.,and Overhead Projector), (Computer and necessary software's, operating systemsetc.)

C) LABORATORY SAFETYEQUIPMENTS

- Fire Extinguishers at least two sets in each laboratory. (Lab. area 600sq.ft.)

- Leakage of gases beavoided.
- Primary medical aid box (First AidKit)
- Sugar / Glucose – 500 gm pack: Pinch of sugar and a cup of drinking water in hypoglycemic condition. OR In extreme weakness of student or personconcerned.
- Rules of animal ethics should be strictlyfollowed.

D) LABORATORYINSTRUCTIONS

1) Always wear an apron inside the laboratory. Do not wear itoutside.

2) Do not drink or eat inside thelaboratory.

3) Do not place pencil, fingers or any material in the mouth. Moisten labelswith water.

4) Use microscopes and other instrumentscarefully.

5) Discard all used glassware such as test tube, pipettes, petry-plates, glassslidesin a receptacle meant forit.

6) Put cotton plugs, papers, matches, waste dissection material etc. in awaste-paper basket. Do not throw them in sink not leave them on desk orfloor.

7) Regard all cultures as pathogenic. Take every precaution againstinfection.

8) Report all accidents to the instructorimmediately.

9) Wash hands thoroughly with soap and water before and after dissectionand experiment.

10) Always turn off water, gas and electricity before leaving thelaboratory.

11) When students enter in laboratory they should have – A Laboratory Journal,pencil and eraser, foot rule, dissection box with dissecting instruments, a smallnapkin.

12) All drawings must be made with drawing pencilonly.

13) As the journal is to represent student's bonafide work during the wholeyear, student should keep it as clean as possible and DO NOT LOOSEIT

14) Students should not forget that unless their journals are certified, they arenot allowed to appear for the universityexamination

11) COMMON NATURE OF QUESTION FOR THEORYPAPER: SEMISTER–V Zoology Paper (IX, X, XI, XII) SEMISTER–VI Zoology Paper (XIII, XIV, XV,XVI)

Q.1	Multiple Choice Questions (Eightquestions)	08
Q.2	Long answer questions (Attempt any two outof three)	16
	A.	
	B.	
	C.	
Q.3	Shorn Notes (Attempt any four outofSix)	16
	a.	
	b.	
	c.	
	d.	
	e.	
	f.	

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Draft Syllabus of B.Sc. Part III Zoology

Zoology Paper- IX

DSC-501 (COMPARATIVE ANATOMY OF VERTEBRATES)

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit 1:IntegumentarySystem	4
1. Generalized structure ofintegument	
2. Functions ofIntegument	
3. Soft and Hard epidermalderivatives	
4.Hard epidermalderivatives	
Unit 2:Habitat and anatomical adaptations	4
Unit3:DigestiveSystem	4
Brief account of alimentary canal and digestive glands	
Unit 4:RespiratorySystem	4
Brief account of Gills, lungs, air sacs	
Unit 5:CirculatorySystem	4
Evolution of heart and aortic arches	
Unit 6: EvolutionofKidney	3
Succession of kidney	
Unit 7:NervousSystem	3
Comparative account of brain	
Unit 8:SenseOrgans	4
Comparative account of ear and eye of vertebrates	

SUGGESTED READINGS:

1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IXEdition
2. The McGraw-Hill Companies. Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and SonsWalter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla PublishingHouse.

3. Outlines of comparative anatomy, Romer & Parsons, Central Book Depot,The Vertebrate Body(Saunders).
4. Biology of Vertebrates Walter & Sayles;(McMillan).
5. Chordate Zoology, P.S. Dhami & J. K. Dhami - R. Chand & Co., NewDelhi.
6. Modern Textbook of Zoology, R. L. Kotpal, Rastogi Publications,Meerut.
7. The Life of Vertebrates, 3rd Edition, 1993, J. Z. Young E. L. B.S.Oxford.
8. Chordate Zoology - E.L. Jordan, S. Chand & Co., NewDelhi.
9. The Phylum Chordata - 1987, H.H. Newman, Distributor Satish Book Enterprise, Agra.8. Comparative Anatomy of the Vertebrates G. C.Kent.

Draft Syllabus of B.Sc. Part III Zoology

Zoology Paper- X

DSC-502 (Molecular Cell Biology and Animal Biotechnology)
Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit 1: Molecular Biology– 7

1) DNA Replication (Semiconservativemode)
2) DNA Damage and Repairmechanism
3) Regulation of gene expression- Operonconcept
4) GeneticCode:
    i) Properties of Geneticcode
    ii) Codonassignment
    iii) Wobblehypothesis

Unit 2:Proteinsynthesis 8

A) Transcription
i) Process in prokaryotes andeukaryotes
ii) RNApolymerase
iii) Post transcriptional modification inRNA
B) Translation in prokaryotes and eukaryotes
i) Initiation
ii) Elongation
iii) Termination

Unit 3 : Molecular Techniques inGenemanipulation 15

1. Restriction enzymes: Nomenclature, detailed study of TypeII.
2. Characteristics of Cloning vectors: Plasmids, Cosmids, Phagemids,Lambda Bacteriophages
3. Gene cloning: Transformation techniques by Calcium chloride methodand

electroporation

4. Construction of genomic and cDNAlibraries
5. Southern, Northern and Westernblotting
6. DNA sequencing: Sangermethod
7. Polymerase ChainReaction,
8. DNA FingerPrinting
9. DNA microarray
10. ELISA
11. Gene Farming

SUGGESTED READINGS:

1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis.II Edition, Academic Press, California, USA. Glick, B.R. and Pasternak, J.J.(2009).
2. Molecular Biotechnology - Principles and Applications of Recombinant DNA.IV Edition, ASM press, Washington, USA. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M.(2009).
3. An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.Snustad, D.P. and Simmons, M.J. (2009).
4. Principles of Genetics. V Edition, John Wiley and Sons Inc. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K.(2007).
5. Recombinant DNAGenes and Genomes- A Short Course. III Edition, Freeman andCo., N.Y., USA. Beauchamp, T.I. and Childress, J.F.(2008).
6. Principles of Biomedical Ethics. VI Edition, Oxford UniversityPress.
7. Cell and Molecular Biology, 8th Edition, De. Robertis EDP and De Robertis Jr.EMF, Lippincott Williams andWilkins,Philadelphia.
8. Cell Biology, C.B. Powar, Himalaya PublicationHouse.
9. Cell and Molecular Biology, EJ. Dupraw, Academic Press,NewYork.
10. Cell Structure and Function - A. G. Loewy, P. Siekevitz, J. R. Meninger & J. A.N. Gallant, Saunder College,Philadelphia.
11. Molecular Biology of the Cell - 3rd Edition, Bruce Alberts, Dennis Bray, JulianLewis, Martin Raff, K. Roberts & James D. Watson, Garian Publishing, NewYork

Draft Syllabus of B.Sc. Part III Zoology

Zoology Paper- XI

DSC-503 (Biotechniques and Biostatistics)

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit I: GeneticallyModifiedOrganisms 9

1. Production of cloned and transgenicanimals:

a. NuclearTransplantation
b. RetroviralMethod
c. DNAmicroinjection

2. Applications of transgenicanimals:
   a. Productions ofpharmaceuticals
   b. Production of donororgans
3. Knockoutmice.

Unit II: Culture TechniquesandApplications 6

a. Animal cell culture: Introduction, principle andapplications
b. Stem Cells: Introduction to stemcells
   i) Potency of stem cells: Totipotency, Pleurepotency,Multipotency, Unipotency
   ii) Sources of stem cells-Embryo, Fetal, Adult, Bonemarrow

Unit III:Biostatistics 15

a. Classification of Biologicaldata
b. Frequencydistribution
c. Tabulation
d. Graphical representation ofdata
e. Measures of central tendency (Mean, Median,Mode)
f. Dispersion – Meandeviation & standarddeviation
g. Correlation – Scattered diagram, Karl Pearson's correlation coefficientand Spearman's rank correlationcoefficient.

Unit IV : Research Tools

a. ANOVA
b. Chi square test
c. Student t test
d. Probability

SUGGESTED READINGS:

1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis.I Edition, Academic Press, California, USA. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principlesand

2. Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M.(2009)
3. An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.Snustad, D.P. and Simmons, M.J. (2009).
4. Principles of Genetics. V Edition, John Wileyand Sons Inc. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K.(2007).

5. Recombinant DNAGenes and Genomes- A Short Course. III Edition, Freeman andCo., N.Y., USA.Beauchamp, T.I. and Childress, J.F.(2008).
6. Principles of Biomedical Ethics. VI Edition Oxford UniversityPress.
7. Elements of Biotechnology - P. K. Gupta, RastogiPublications.
8. Gene V & VI, 1994, Lewin B., Oxford University Press,Oxford.
9. Concept of Genes-Pearson Edition 9.Cell and MolecularBiology

Draft Syllabus of B.Sc. Part III Zoology

Zoology Paper- XII

DSC-504 (AQUATIC BIOLOGY) A

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit 1:AquaticBiomes **10**

a. Freshwater ecosystem (lakes, wetlands, streams andrivers),
b. Estuaries
c. Intertidalzones
d. Oceanic pelagiczone
e. Marine benthiczone
f. Coralreefs

Unit 2:FreshwaterBiology **10**

1. Lakes
    a. Lake as anEcosystem
    b. LakeMorphometry
    c. Physico-chemicalcharacteristics
        i. Light
        ii. Temperature
        iii. ThermalStratification
        iv. Dissolvedsolids
        v. Carbonates
        vi. Bicarbonates
        vii. Phosphates andNitrates
        viii. Turbidity
        ix. Dissolved gases (Oxygen Carbondioxide)
        x. Nutrient Cycle – (Nitrogen, Sulphur andPhosphorus)

2. Streams
    a. Different stages of streamdevelopment
    b. Physico-chemicalEnvironment
    c. Adaptation of hill streamfishes

Unit 3: Endocrinology 08

a. Study of endocrine glands – Anatomy and histology

b. Hormones- Nature, role, regulation and disorders with reference to the following

thyroid gland, parathyroid gland, adrenal gland and islets of Langerhans

Unit 4 : Fish Toxicology **02**

a. Pesticide effects

b. Aquaculture drugs

Unit 5 : Skill based

1. Foundations of Research

Meaning, Objectives, Motivation: Research Methods *vs* Methodology, Types of Research: Analytical *vs* Descriptive, Quantitative *vs* Qualitative, Basic *vs* Applied

2. Research Design

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

3. Teaching Methodology

Materials development and syllabus design,Teacher education and critical pedagogy, Technology and language teaching, Sociocultural Theory of language learning, Classroom Management

SUGGESTED READINGS:

1. Anathakrishnan : Bioresources Ecology 3rdEdition
2. Goldman : Limnology, 2ndEdition
3. dum and Barrett : Fundamentals of Ecology, 5thEdition
4. Pawlowski : Physicochemical Methods for Water and Wastewater Treatment,1st
5. Edition Wetzel : Limnology, 3rdedition
6. Trivedi and Goyal : Chemical and biological methods for water pollutionstudies
7. Welch : Limnology Vols. I-II
8. Animal Physiology – Nelson (Cambridge)
9. Endocrinology – Hadely
10. General Endocrinology – Bangara and Turner (W.B. Saunders)
11. Reproductive Physiology – Nalbandov A. V.

Zoology Paper- XII

DSC-504 (ANIMAL BEHAVIOUR) B

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit 1: Introduction and mechanisms of behaviour

a. Origin and history
b. Objective
c. Sign stimuli
d. Code breakers

Unit 2: Patterns of Behaviour

a. Reflexes: Types of reflexes, reflex path, characteristics of reflexes and its comparison with complex behaviour

b. Orientation: Learning: Associative learning, classical and operant conditioning, Habituation, Imprinting

c. Social Behaviour : Insects' society; Honey bee

Unit 3: Altruism

a. Reciprocal altruism
b. Hamilton's rule
c. Inclusive fitness with suitable examples
d. **Sexual Behaviour**

Unit 4: Biological Clocks

a. Circadian rhythms
b. Tidal rhythms
c. Lunar rhythms
d. Advantages of biological clocks
e. Jet lag

Unit 5 : Skill based

1. Foundations of Research

Meaning, Objectives, Motivation: Research Methods *vs* Methodology, Types of Research: Analytical *vs* Descriptive, Quantitative *vs* Qualitative, Basic *vs* Applied

2. Research Design

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

3. Teaching Methodology

Materials development and syllabus design,Teacher education and critical pedagogy, Technology and language teaching, Sociocultural Theory of language learning, Classroom Management

SUGGESTED READINGS:

1. David McFarland, Animal Behaviour, Pitman Publishing Limited,London, UK.

2. Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge University Press, UK.

3. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.

4. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA

Zoology Paper- XII

DSC - 504 (WILD LIFE CONSERVATION AND MANAGEMENT) C

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit 1:Wild life - Values of wild life conservation ethics, Importance, **Habitat analysis, Evaluation and management of wild life - Physical parameters,** Biological ParametersandStandard evaluation procedures

Unit 2 :Management of habitats Population estimation Faecal analysis of ungulates and carnivores Pug marks and census method.

Unit 3 :National Organizations, Wild life Legislation, Management planning of wild life in protected areas; Estimation of carrying capacity;Eco tourism in forests; Concept of climax persistence; Ecology of perturbence.

Unit 4 :Management of excess population & translocation; Bio- telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal, **Protected areas, Community reserve; Important features of**protected areas in India; Tiger reserves in India; Management challenges

Unit 5 : Skill based 20%

1. Foundations of Research

Meaning, Objectives, Motivation: Research Methods *vs* Methodology, Types of Research: Analytical *vs* Descriptive, Quantitative *vs* Qualitative, Basic *vs* Applied

2. Research Design

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.

3. Teaching Methodology

Zoology Paper- XIII

DSC-601 (DEVELOPMENTAL BIOLOGY OF VERTEBRATES)

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit 1:Gametogenesis

1. Types ofEggs
2. Fertilization – Types and Process of Fertilization
3. Types ofCleavages

Unit 2: Early DevelopmentofFrog 6

1. Structure of mature egg and itsmembranes
2. Cleavage
3. Blastula and its fatemap
4. Process ofgastrulation
5. Types of MorphogenicMovements
6. Fate of three germinallayers
7. Neurulation
8. Metamorphosis in frog and its hormonalregulation

Unit 3:ChickEmbryology 15

1. Structure of sperm
2. Structure of egg andvitellogenesis
3. Fertilization andcleavage
4. Blastula and its fatemap
5. Process ofgastrulation
6. Organogenesis
    a. Development of neural tube and brain up to 72 hours ofincubation
    b. Development of gut up to 72 hours ofincubation
    c. Development of blood and heart up to 72 hours ofincubation
    d. Foetal membranes andsignificance

Unit 4: LateEmbryonicDevelopment 3

1. Implantation of embryo in humanbeing
2. Placenta – Formation, types andsignificance
3. Foetal membranes and their importance in humans

SUGGESTED READINGS:

1. An Introduction to Embryology 1981, Balinsky B.L., SaundersCollege,Philadelphia.
2. Developmental Biology; Patterns/Principles/Problems, 1982, Saunders J. W.Collier MacMillan, Publishers,London.
3. Developmental Biology, 1997, 3rd Edition, Gilbert S.F. Saunder Associates Inc.U.S.A.
4. Developmental Biology, 1992 3rd edition, Browder L.W. Erickson C.A. & Williams,R J. Saunders College, Publications, London.
5. A Text Book of Embryology, Dr. Puranik P. G., S. Chand & Co. 6.Developmental Biology, 1984, Browder L.W. , Saunders College Publicaions,U.S.A.
6. Development of Chick embryo, 1972, Lillie. 8. Developmental Biology, 1991,3rd Edition, Sinaur Associates, Inc. U.S.A.Gilbert, S. F.(2006).

7. Developmental Biology, VIII Edition, Sinauer Associates, Inc.,Publishers, Sunderland, Massachusetts, USA. Balinsky, B.I.(2008).
8. An introduction to Embryology, International Thomson ComputerPress. Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill,Inc.

Draft Syllabus of B.Sc. Part III Zoology

Zoology Paper- XIV

DSC-602 (IMMUNOLOGY)

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit 1: Overview of theImmuneSystem 7

1. Introduction to basic concept in immunology
2. Principles of innate and adaptive immunesystem
3. Immuno- therapeutic strategies against pathogens vaccination

Unit 2: Cells and Organs of theimmunesystem 8

1. Haematopoeisis
2. Lymphocyte synthesis

Unit 3:Antigens 7

1. Basic properties ofantigens
2. B and T cellepitopes

Unit 4: Immunoglobulin/Antibodies 8

1. Structure, Classes and Functions ofAntibodies
2. Antigen – Antibodyinteractions
3. Hybridoma Technology: Monoclonal Antibodies in diagnosis andtherapeutics
4. Disposal and pollution of Pharmaceuticals

SUGGESTED READINGS:

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VIEdition. W.H. Freeman and Company. David, M., Jonathan, B., David, R. B. and Ivan R.(2006).
2. Immunology, VII Edition, Mosby, Elsevier Publication. Abbas, K. Abul andLechtman H. Andrew (2003.) Cellular and Molecular
3. Immunology. V Edition. SaundersPublication

Draft Syllabus of B.Sc. Part III Zoology

Zoology Paper- XV

DSC-603 (Applied Zoology - II)

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit1:Apiculture 8

1. Types and casts of honeybee
2. HoneyComb
3. BeeKeeping
    a. Artificial models of bee hive – Newton and Langstrothmodels
    b. Bee keepingEquipments
    c. Extraction ofHoney
4. Medicinal Value ofHoney

Unit 2 :AnimalHusbandary 5

1. Indigenous and exotic breeds ofcattle
2. Preservation and artificial insemination incattle
3. Induction of earlypuberty
4. Synchronization of estrus incattle
5. Commercial importance of dairyfarming

Unit 3:Pearlculture 4

1. Species ofoyster
2. Process of Pearl formation: natural andartificial
3. Maintenance ofoysters
4. Harvesting
5. Importance ofPearl

Unit 4: Freshwaterprawnculture **3**

1. Species ofPrawn
2. Siteselection
3. FarmConstruction
4. Production system: fertilization, Larval Development, Food andfeeding
5. Harvesting

Unit 5:FishTechnology **5**

Genetic improvements in aquaculture industry:

1. Inducedbreeding
2. Transportation of fishseed
3. Feeding anddevelopment
4. Harvesting andMarketing

Unit 6 : Production and marketing of milk products

SUGGESTED READINGS:

1. Mollusca -Hyman.
2. Prawn and Prawn Fishery of India -Kurian.
3. Fish Culture - K. H.Alikuhni.
4. Fish Culture -Lagter.
5. Fishes of India. -Khanna.
6. Hand Book of Animal Husbandary and Dairy -Mudlyer.
7. Bee keeping in India - SardarSing.
8. Bee Keeping in India- M. G.Smith.
9. Poultry keeping in India - NaiduP.N.M.
10. Poultry Husbandary - M. A. Jule. 18. Poultry Husbandary -Moarthy.
11. Outlines of Dairy Technology - SukumarDe.
12. Milk and milk products - Clarence Henry Eckles,Willes Barnes Combs, HaroldMacy

Draft Syllabus of B.Sc. Part III Zoology

Zoology Paper- XVI

DSC-604 (Insect Vectors and Histology) A

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit I: Dipteran asDiseaseVectors

18

1. Dipteran as important insectvectors
    a. Mosquitoes
    b. Sandfly
    c. Houseflies
2. Study of mosquito born diseases–
    a. Malaria
    b. Dengue
    c. Chikungunya

d. Viralencephalitis
e. Filariasis
f. Horse fly
g. Black fly
h. Ticks and Mites

3. Control measures ofMosquitoes
4. Study of house fly as important mechanicalvector
    a. Myiasis, Control of housefly

Unit II: Siphonoptera asDiseaseVectors

6

1. Fleas a important insectvectors
2. Host-specificity
3. Study of Flea-bornediseases
    a. Plague
    b. Typhusfever
4. Control offleas

Unit III: Histology of mammalian organs

6

Tooth, tongue, Salivary glands, Stomach, Duodenum, Ileum, Liver, Pancreas, Kidney

Unit IV :

1. Data Collection, Analysis and Report Writing

Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis

2. Ethical Issues

Intellectual property Rights, Commercialization, Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement

3. Teaching Methodology

English for Specific Purposes (ESP)/ English for Academic Purposes (EAP), Strategies-based instruction, Integrated language skills, Reflective language teaching, Needs Analysis

SUGGESTED READINGS:

1. Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK Chapman, R.F.(1998).
2. The Insects: Structure and Function. IV Edition, Cambridge University Press, UK Pedigo L.P.(2002).
3. Entomology and Pest Management. Prentice Hall PublicationMathews, G.(2011).

4. Integrated Vector Management: Controlling Vectors ofMalaria
5. Insect Vector Borne Diseases.Wiley-Blackwell
6. Textbook of Histology: Bloom W and Fawcett D.W.
7. Histology: Lippinocott. Ham, A.W.
8. Histology: Greep, R.O and well, L.
9. An Atlas of Histology. Heinemann Educational Book Ltd. London and ELBS: Freeman. W.H. and Bracegirdle, B.
10. Microscopic Anatomy of vertebrates, Lea and Febigen. Philaldelphia: Kendall, J.I.
11. Histology of Mammals: Athavale, M.V and Latey, A. N.

Draft Syllabus of B.Sc. Part III Zoology

Zoology Paper- XVI

DSC-604 (OCEANOGRAPHY)B

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit 1:Geologic history of the oceans - Early history of Oceanography and World exploration -
Modern Technology in Oceanography - Seas - Oceans - Ocean floor - Continental shelf - Continental slope - Abyssal basin - Introduction to hydrographic surveying; Marine instrumentation - Echosounder - Side Sanning Sonar - marine navigator (GPS) – underwater camera, etc., - Marine structures - vehicles - long term geologic history of oceans.

Unit 2:Sea as a biological environment - Plankton, classification of plankton based on size,
mode of life and habitat. Phytoplankton and zooplankton - methods of collection, plankton volume, settling and displacement methods; Adaptations of plankton; Phytoplankton and zooplankton interrelations

Unit 3:Organic production - primary and secondary productions, methods of estimation of
primary production, factors affecting primary production, regional differences production (in primary and secondary), red tide phenomenon - its causes and effects

Unit 4:Introduction to marine life - Life process in the marine environment - Ocean's Food web
Fish in Schools- Sharks - Lobsters - Marine flora - sea weeds and sea grass; Mangroves and salt marshes - distribution - adaptations (morphological, anatomical and physiological), ecological role, uses, need for conservation

Unit 5 : Skill based

1. Data Collection, Analysis and Report Writing
Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis
2. Ethical Issues
Intellectual property Rights, Commercialization, Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement
3. Teaching Methodology
English for Specific Purposes (ESP)/ English for Academic Purposes (EAP), Strategies-based instruction, Integrated language skills, Reflective language teaching, Needs Analysis

SUGGESTED READINGS

1. **Physical oceanography A Short Course of Beginners Y. D. Afanasyev**
2. **Descriptive Physical Oceanography, Sixth Edition, Lynne D. Talley**
3. **Introduction to oceanography Harold V. Thurnam**
4. **Oceanography for geographers By R. C. Sharma & M. Vatal**

Draft Syllabus of B.Sc. Part III Zoology

Zoology Paper- XVI

DSC-604 (BIOTECHNIQUES)C

Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

1. Assays –Definition and criteria of reliability; Chemical assays; Biological assays – in*vivo and vitro assays.*

2. Principles and uses of analytical instruments – Balances, pH meter, calorimeter, spectrophotometer, centrifuge, ultracentrifuge.
3. Microscopy – Principle of light transmission, electron, phase- contrast, fluorescence, electron, confocal, scanning electron microscopes. Microphotography. Image analysers.
4. Microbiological techniques –Media preparation and sterilization; Inoculation and growth monitoring; Use of fermenters; Microbial assays.
5. Cell culture techniques –Design and functioning of tissue culture laboratory; Cell viability testing; Culture media preparation and cell harvesting methods.
6. Separation techniques in biology –Molecular separations by chromatography, electrophoresis, precipitation etc.
7. Computer aided techniques for data presentation, data analyses, statistical techniques, special software for specific tasks.
8. Radioisotope and mass isotope techniques in biology –Autoradiography; Magnetic Resonance Imaging.
9. Immunological techniques based on antigen - antibody interactions.
10. Surgical techniques –Organ ablutions (eg; ovariectomy, adrenaletomy etc.); Perfusion techniques.

Unit 5 : Skill based 20%

1. Data Collection, Analysis and Report Writing

Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis

2. Ethical Issues

Intellectual property Rights, Commercialization, Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement

3. Teaching Methodology

English for Specific Purposes (ESP)/ English for Academic Purposes (EAP), Strategies-based instruction, Integrated language skills, Reflective language teaching, Needs Analysis

Zoology

Advance Diploma B. Sc III

Nutrition & Dietetics (Credits 2)

1. Organization and management:

a) Definition and types of organization.

b) Definition- functions and tools of management.

c) Technique of effective management and its application to food preparation and science.

2. Food material management:

a) Meaning, definition, and importance.

b) Food selection, purchasing, receiving and storeroom management.

c) Control in relation to the above operations (material planning, budgeting, material identification, modification and standardization, inventory control, store keeping, definition, objectives, functions, factors underlying successful storekeeping, duties and responsibilities of a storekeeper, purchasing, organization, principle, procedure, systems and quality control).

3. Personnel Management:

Recruitment, selection and training of personalities, work standards, productivity, supervision, performance appraisal and motivation incentives for effective performances.

4. Labour policies and legislation:

(Personnel policies related to salaries, other emoluments, allowances, leave, uniform and other prize benefit, laws and organization)- Laws affecting food service institution to study the following: (hospital, flight kitchen, hotel, restaurant, canteen, Industrial) –

a. Organization

b. Physical plan and layout

c. Food and silver equipment

d. Sanitation and hygiene.

PRACTICALS

Visit and appraisal of any two medical organization.

1. Work simplification: food preparation, Calculating work unit, time norms etc.
2. Costing, accounting, budgeting, purchase.
3. Storekeeping: Listing and management of food items in the store.

4. Personnel recruitment: Preparations of a project and report making.
5. Maintenance of the clothing for persons and staff involved in kitchen area.
6. Prepare an inventory for evaluating staffs personal hygiene.

Entrepreneurship Development course
Syllabus
Theory: 30 hrs. (37.5 lectures of 48 minutes) (Credits 2)

Unit 1. Animal Husbandry - Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle

Unit 2. Poultry Farming - Principles of poultry breeding, Management of breeding stock and broilers

Unit 3. Fish Technology - Concept of monoculture, polyculture, monosex culture, pen culture, cage culture, Induced breeding and transportation of fish seed

Unit 4. Apiculture- Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens

Entrepreneurship Skills

1. 3-D printing
2. The development of bacterial functional genomics
3.Next-generation DNA sequencing technologies, the development of new synthetic antibiotics for certain drug-resistant pathogens.
4. The developments of new real-time isotope imaging detectors for understanding climate change in the agricultural industry.

PRACTICALS

1 Digital Manufacturing- Interactive Exercise: Design for 3D Print
2.Construction and management of poultry farm/ animal breeding center/ Apiculture.
3. Visit to poultry farm/ animal breeding center/ Apiculture.
4. Submission of report on poultry farm/ animal breeding center/ Apiculture.

REFERENCES

- Hafez, E. S. E. (1962). Reproduction in Farm Animals. Lea & Fabiger Publisher
- Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K.
- **3D Printing: The Next Industrial Revolution,** by Christopher Barnatt, 2013. *History of 3D printing and a comprehensive survey of 3D printing technologies and companies.*
- **Fabricated: The New World of 3D Printing,** by Hod Lipson and Melba Kurman. John Wiley, 2013. *An in-depth look at current technology and the future of 3D printing.*

Draft Syllabus of B.Sc.
Part IIIZoology Zoology
Practical – I(Credits-02)

Comparative anatomy and developmental biology of vertebrates

I. Comparative Study offollowing

1. V.S. of skin ofvertebrates
2. Digestive system ofvertebrates
3. Respiratory system ofvertebrates
4. Heart ofvertebrates
5. Brain ofvertebrates
6. Osteology
    a) The skeleton of fowl(Disarticulated)
    b) The skeleton of rabbit(Disarticulated)
    c) Mammalian skull's – (any one herbivorous and one carnivorousanimal)

II. Study of developmental stages offrog.

1. Cleavage
2. Blastulation
3. Gastrulation
4. Neurulation
5. Stages of metamorphosis in frog
    a. External gillstage
    b. Internal gillstage
    c. Forelimbstage
    d. Hind limbstage
    e. Tail bud stage
    f. Juvenilestage

III. Study of ecological adaptations

1. Lotic
2. Lentic
3. Benthic
4. Pelagic
5. Grassland
6. Desert

IV.Study of ChickEmbryo

1. Whole mount of chick embryo – 18, 24, 33, 48 and 72hours.
2. T.S. of chick embryo – 18, 24, 33, 48 and 72hours.

V. Preparation of whole mount chick embryo.

VI. Study of Histological structures of placenta (permanent slide ormicrophotographs)

1) Epitheliochorial
2) Endotheliochorial
3) Hemochorial
4) Syndesmochorial
5) Hemoendothelial

VII. Examination of Gametes – Frog or Rat sperm & ovum through slides ormicrophotographs.

Draft Syllabus of B.Sc. Part IIIZoology Zoology Practical –

II(Credits-02)

Applied Zoology – II and Immunology

Unit 1: Applied Zoology

1. Apiculture
    a. Casts of HoneyBees
    b. Bee Hive(Photographs ormodels)
    c. Pollen Basket
    d. StingApparatus
    e. Honey
    f. Newton's model of Bee Hive (Photographs ormodels)
    g. Bee keeping Equipments (Photographs ormodels)

2. Preservation & Artificial insemination incattles
3. Pearl culture
    a. Species ofoyster
    b. Process of Pearl formation: natural andartificial
    c. Importance ofPearl
4. Freshwater prawnculture
    a. Species of Prawn
    b. Siteselection
    c. FarmConstruction
    d. Productionsystem
    e. Harvesting
5. Goat farming
    a. Breeds (any four = 2 Indigenous and 2Exotic)
    b. Housing
    c. Feeding
6. Economic importance of Milk and Milk byproducts

7. Visit to goat farm or animal breeding center – submission of visit report

B] Immunology

1. Study of lymphoid organ's (Photograph, Models,Videos)
2. Histological study of (slides orphotographs)
    a. Spleen
    b. Thymus
    c. Lymph nodes
3. Preparation of stained blood smears to study various types of bloodcells
4. Determination of ABO bloodgroups
5. Demonstrationof
    a. ELISA
    b. Immuno-electrophoresis

C] Cell counting and viability test from splenocytes of farm breed animals / cellline

Zoology Zoology Practical – III
(Credits-02)
Molecular biology, Animal biotechnology, Biostatistics & Biotechniques

I] Microtechnique

1. Preparation of permanent histological slides by HEtechnique
2. Histochemicaltechnique
    a. AB PH 1technique
    b. AB PH 2.5technique
    c. PAStechnique

II] Biotechniques

1. Chromatography – Separation of amino acid by paperchromatography
2. DNAisolation
3. Demonstration of DNA by Feulgentechnique
4. To study the following technique (photographs)
    a) Southern blotting
    b) Northernblotting
    c) Westernblotting
    d) DNA sequencing (Sangersmethod)
    e) PCR
    f) DNAfingerprinting

III) Biostatistics

Any 10 example based on theory

IV] Project (any suitable work possible in local area or from the syllabus)
Report of the same to be submitted at the time of practical examination

V] Submission of online course certificate

Draft Syllabus of B.Sc. Part III
Zoology Practical – IV (Credits-02)
Aquatic biology, insect vector & diseases

A] Aquatic biology

1. Determination of area of a lake using graphimetric & gravimetricmethod
2. Identify the zooplanktons present in lakeecosystem
3. Determination of turbidity or transparency from nearby lake or waterbody
4. Determination of dissolvedoxygen
5. Determination of freeCO_2
6. Determination of alkalinity (Carbonates & bicarbonates) from water collected fromnearby lake or waterbody
7. Estimation of total hardness ofwater
8. Instruments used in limnology & theirsignificance
    a) Secchidisc

b) Van Dornbottle
c) Conductivitymeter
d) Turbiditymeter
e) PONAR grabsampler

9. Visit to seashore/water reservoir/animal sanctuary to study animal diversity. Reportof tour should be submitted at the time of practicalexamination
10. Endocrine glands (Anatomy and Histology) – Thyroid, Parathyroid, Adrenal and Pancreas.

B] Insect Vectors &diseases

10. Study of different kinds of mouthparts ofinsects
    a) Chewing &biting
    b) Chewing &lapping
    c) Piercing &sucking
    d) Sponging
    e) Siphoning
11. Study of following insect vectors through permanent slides orphotograph
    a) Insect vector – Mosquito, sandfly &housefly
    b) Study of mosquito born diseases – Malaria, dengue, chikungunya, encephalitis,filariasis
    c) Study of sandfly born diseases – Visceral leishmanians, Cutaneousleishmanians, Phlebotomus fever
    d) Study of housefly born diseases –Myiasis
    e) Study of flea born diseases – Plague,typhus
12. Histology of Following mammalian organs-
    a) Tooth (V.S.) b) Tongue c) Salivary gland d) Stomach e) Duodenum
    f) Ileum g) Liver h) Pancreas i) Kidneys

B.Sc III Fisheries Syllabus

Proposed draft Syllabus for B.Sc. III Fisheries
Submitted to
Yashavantrao Chavan Institute of Science, Satara
(Autonomous)
Under
Choice Based Credit System (CBCS)
(June 2020-2021)
B.Sc. Part III Fisheries
Semester V
Paper V:(Fishery Biology II and Aquaculture Management)
Paper VI:Fish Physiology II ,fish breeding, fish seed production and transport.
New B- Fishery Economics, Fish Marketing, Fishery Extension & Co-operatives, Financing in Fishery, Disaster Management
New c - Fish Products and Byproducts Technology

Semester VI

Paper VII: Marine Ecology and Fisheries

Paper VIII: Fish Pathology and Fishery Technology

New B- Fish nutrition

New c - Fishery education, extension and economics of aquaculture .

Yashavantrao Chavan Institute of Science, Satara

(Autonomous)

Syllabus for Bachelor of Science Part III

I) Title: Fisheries

II) Year of implementation: 2020-2021

III) Preamble:

1. To impart the knowledge of animal science to the pupils.
2. To make the pupil to use the knowledge in their daily life
3. To make the pupil aware of natural resources and environment
4. Application of knowledge in Fisheries for nutrition Aquaculture practice.
5. To provide practical experiences which form the part of their learning processes.
6. To develop aptitude for scientific work and ability to pursue studies far beyond graduation
7. To encourage the pupil to take life science as a carrier which is the need now a day
8. To make the pupil fit for the society

IV) General Objectives of the course:

1. To impart the knowledge is the basic aim of education. The students are expected to acquire the knowledge of animal science, natural phenomenon, manipulation of nature and environment by man.
2. Understanding the scientific terms, concepts, facts, phenomenon and their interrelationships.
3. Applications of the knowledge
4. To develop skills in practical work, experiments and laboratory materials, instruments
5. To develop interest in the subject and scientific hobbies
6. To develop scientific attitude which is the major objective, this makes the students open minded, critical observations, curiosity, thinking etc.
7. Abilities to apply scientific methods, collection of scientific data, problem solving, organize science exhibitions, clubs etc.
8. Appreciation of the subject, contribution of the scientists, scientific methods, scientific programmes etc.

V) Duration:

1. The course shall be full time course
2. The duration of course shall be one year.

VI) Pattern:

Pattern of examination will be semester for theory and practical with internal assessment scheme. (Seminar / Industrial Visit/ Educational Tour/ Project/ Field Visit)

VII) Medium of instruction:

The medium of instruction shall be in English

VIII) Structure of Course:

B.Sc. III Fisheries

Semester V – Number of papers 2

Paper V: (Fishery Biology II and Aquaculture Management)

Paper VI: Fish Physiology II, Biostatistics and Bioinformatics.

New B- Fishery Economics, Fish Marketing, Fishery Extension & Cooperatives, Financing in Fishery, Disaster Management

New c - Fish Products and Byproducts Technology

Semester VI-Number of papers 2

Paper VII: Marine Ecology and Fisheries

Paper VIII: Fish Pathology and Fishery Technology

New B- Fish nutrition

New c - Fishery education, extension and economics of aquaculture .

Rayat Shikshan Sanstha's

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA

(AUTONOMOUS INSTITUTE)

Syllabus for B.Sc. Part – III introduced from June, 2020

1.Structure of Syllabus:

B.Sc. – III **Semester –III**

Sr. No.	Course Title	Theory			Practical		
		Paper No.& Paper Code	No. of lectures Per week	Credits	Course Title	No. of lectures per week	Credits
1	Fisheries	Paper-V: BZFT501	3	2	Practical Paper – I : BZFP303	8	4
		Paper-VI: BZFT502	3	2			

B.Sc. – III **Semester –VI**

Sr. No.	Course Title	Theory			Practical		
		Paper No.& Paper Code	No. of lectures Per week	Credits	Course Title	No. of lectures Per week	Credits
1	Fisheries	Paper-:VII BZFT 603	3	2	Practical Paper – II: BZFP403	8	4
		Paper-VIII: BZFT604	3	2			

Note: B: B. Sc. T=Theory and P= Practical

Evaluation Structure: B.Sc.III Sem- V &VI (Fisheries)

Semester	Paper No.& Code	ESE	InternalExam		Paper No. & Code	Practical		Submission		Total
			ISE I	ISE II		Exam	Journal	Seminar	Day to Day Performance	
V	Paper V :BZFT501	30	5	5	Pr. Paper I: BZFP 303(A)	25	5	5	5	**150**
	Paper VI :BZFT502	30	5	5	Pr. Paper I: BZFP 303(B)	25	5			
	Total	60	10	10	Total	50	10	5	5	**150**
VI	Paper VII BZFT 601	30	5	5	Pr. Paper II: BZFP 403(A)	25	5	5	5	**150**
	Paper VIII :BZFT 602	30	5	5	Pr. Paper II: BZFP 403(B)	25	5			
	Total	60	10	10	Total	50	10	5	5	**150**
Total of Sem. III &IV		120	20	20	Total	100	20	10	10	**300**

B. Sc. Part III Semester- V
FISHERIES
PAPER-V
BZFT- 501 (Fishery Biology II and Aquaculture Management)
Theory: 36 hrs. (45 lectures of 48 minutes)
Marks-50 (Credits: 02)

Unit I

A. Method in gut content analysis **3**

B. i.Fish nutrition: principle of fish nutrition and terminologies. **10**

ii . Nutritional requirments of cultivable fin fishes: larvae, juvenile and adults.

iii. Nutritional biochemistry : classification, nutrients quality and evaluation of protein, lipid and carbohydrates.

iv. Role of nutrients: amino acid and fatty acid

Unit II

A. Type study - Prawn (*Palaemon* sp.) **11**

i. Systematic position

ii. Habits and habitat

iii. External morphology

iv. Functional an atomy of:

a) Digestive system

b) Respiratory system

c) Circulatory system

d) Excretory system

e) Nervous system and sense organs- Eye and Statocyst.

f) Reproductive system and life cycle

Unit III **7**

Type study Bivalve . **4**

i. Systematic position

ii.Habits and habitat

iii external morphology

iv functional anatomy of

a) Digestive system

b) Excretory system

c)Reproductive system

d) Respiratory system

Oyster culture (Edible and pearl).

i) Species- edible and pearl.

ii) Culture methods.

B. Prawn culture: Stocking, pond, Maintenance and harvesting. 7

Unit IV

Integrated fish farming and its economics.

7

A. Fish farming with Agriculture:

Rice cum fish culture

i Culturable species in rice fields ii.Rotational and simultaneous culture

B. Fish farming with live stock-Duck, Pig& Cattle fish culture

C. Sewage fedfisheries

D. Culture of air breathing fishes.

E. Cold water fisheries (Mahaseer fish)

F. Fish farm Management:

G. Brood stock and hatchery management, Nursery management, Rearing and Stocking.

B. Sc. Part III Semester- V

FISHERIES

PAPER-VI

BZFT- 502 Fish Physiology II ,fish breeding, fish seed production and transportation.

Theory: 36 hrs. (45 lectures of 48 minutes)

Marks-50 (Credits: 02)

Unit I

A. Study of endocrine glands

Anatomy , role of hormones and their regulation with reference to : **5**

a) Pituitary gland

b)Thyroid gland

Unit II

A. Study of endocrine glands **12**

Histology, role of hormones and their regulation with reference to:

a) Pituitary gland

b) Inter-renal gland

c) Corpuscles of Stannius

d) Gonads

e) Hepatopancreas

f)Thyroid gland

B. Ecological and hormonal influence maturation of gonads and spawning. 3

Unit III

Breeding in Indian Major Carps. 6

i Natural breeding .

ii Induced breeding .

iii breeding of ornamental fishes 4

a) Oviparous

b) Live bearers.

a) Feed Resources: Nutritional value of feed ingredients and live feed. **7**

b) Importance of natural food to nutrient requirements of fish

c) Feed additives -attractants, growth stimulants and probiotics and binders

Unit IV

Fish Seed resources and their transport **8**

a) Fish seed from river, hapas, hatcheries

b) Fertilization of eggs by stripping.

c) Transport of fish seeds.

d) Transport of fingerlings and brood fishes.

Total 45

B. Sc. Part III

BZFP 503

FISHERY PRACTICAL-I

Marks-50 (Credits: 02)

Group A: Practical I (based on papers V and VI)

Unit I

Dissection of Prawn **4**

a. Digestive system.

b . Nervous system.

c .Mountings.

i .Mouth parts

ii .Thoracic appendages

iii .Abdominal appendages

iv.Cornea

v .Statocyst

Unit II

Micro technique Microtechnique of following 3

Pituitary gland / endocrine gland Testis Intestine/ oesophagus,stomach.

Dissection of Bivalve . **4**

a . Digestive system

b . Nervous system

c . Study of:

d Gills

e Heart

study of *Glochidium* larva 2

Identification of larval/life cycle stages of Prawn/shrimp Mytilus Fish 2

Identification of following 4

Weeds: Eichornia, Marcelia, Hydrilla, Pistia, Spirogyra. b. Weed fishes: Rasbora , Puntiusticto, and Tilapia c. Predatory fishes: Clarius, Anabas and Eel. d. Food and fertilizers: Lime, NPK fertilizers and fish meal.

Unit III

1 Study of locally available feed ingredients (Any 5)

2 Estimation of crude protein from feed ingredients and feed.

3 Estimation of lipid from feed ingredients and feed.

4 Estimation of carbohydrate from feed ingredients and feed.

5 Estimation of vitamin from feed ingredients and feed.

6. Method of gut content analysis.

Field visit to fish farm/ report writing on fish fish seed transport.

B. Sc. Part III Semester- V

FISHERIES

PAPER-V

BZFT- 505 New B-Fishery Economics, Fish Marketing, Fishery Extension & Co-operatives, Financing in Fishery, Disaster Management

Theory: 36 hrs. (45 lectures of 48 minutes)

Marks-50 (Credits: 02)

Unit I

Fishery Economics 13

i) Principles of economics: Definition, Law of diminishing returns, laws of increasing, constant and decreasing utility and returns. ii) Importance of economics in aquaculture development. iii) Economic value of fishes, iv) Maximum Sustainable Yield (MSY), Maximum Economic Yield (MEY), Optimum Sustainable Yield (OSY) v) Overfishing, Aquaranching (Culture based capture method) vi) Economy of fishermen: Fishermen populations, GDP from fisheries sector, foreign exchange earnings and employment potential of fishing industry.

Unit II

Fish Marketing 13

i) Fish marketing- definition, Aim, Characteristic, Types and Stages of fish marketing. ii) Marketing channels and supply chain, Marketing margins, Marketing environment, Marketing strategies, Consumer behaviour iii) Fish markets and marketing in India, Problems of fish marketing in India. iv) Cold storage and other marketing infrastructure in India. v) Methods of selling fish, Price Determination marketing organization and improvement. vi) Exports of fish and fishery products, trends and problems therein. Role of MPEDA in exports of fish and fishery products.

Unit III 5

Fishery Extension & Co-operatives i) Fishery co-operative- Aim and role of co-operative in fishery economy. Organization of fishermen co-operatives. ii) Fisheries extension- Definition, extension philosophy and Methodology iii) Fishing community and their socio- economic problems. iv) Fish farmers development Agencies (FFDA)

Unit-IV:

Scopes & Financing in Fishery Management i) Study, Training & Research 6 opportunities in Fisheries in India with special reference to NER ii) Credit Requirements & Role of credit for fisheries iii) Schemes of National Fishery Development Board (NFDB) & NABARD iv) Role of District Fishery Development Office. v) Role of insurance in Fish Farming Industry.

Unit-V: Skill based 20% **8**

1. Foundations of Research

Meaning, Objectives, Motivation: Research Methods vsMethodology, Types of Research: Analytical vsDescriptive, Quantitative vs Qualitative, Basic vs Applied

2. Research Design

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

3. Teaching Methodology

Materials development and syllabus design,Teacher education and critical pedagogy, Technology and language teaching, Sociocultural Theory of language learning, Classroom Management. Total 45

B. Sc. Part III Semester- V

FISHERIES

PAPER- New c Fish Products and Byproducts Technology

Theory: 36 hrs. (45 lectures of 48 minutes)

Marks-50 (Credits: 02)

Unit I **12**

Principle of fish preservation and processing. Processing of fish by traditional methods – salting, sun drying, smoking, marinading and fermentation. Theory of salting, methods of salting –wet salting and dry salting. Drying and dehydration- theory, importance of water activity in relation to microbial growth .Sun drying and artificial drying- solar dryer. Packaging and storage of salted and dried fish. Different types of spoilage in salt cured fish. Quality standard for salted and dry fish. Fish

Unit II **12**

preservation by smoking- chemical composition of wood smoke and their role in preservation. Methods of smoking and equipments used for smoking. Carcinogenic compound in wood and methods to remove them. Hurdle technology in fish preservation and processing. Marinaded and fermented fish products – role of acids in marinades, Fish and prawn pickles, fish sauce and Fish paste, traditional Indian fermented products. Principles and methods of preparation of various fish paste products like fish sausage, fish ham, surimi, fish cake, kamaboko etc. Fish muscle structure, myofibriller protein and their role in elasticity formation.

Unit III **9**

Extruded products – theory of extrusion, equipments used, advantages of extruded products, methods of preparation of extruded products. Fish protein concentrate. Fish hydrolysate, partially hydrolyzed and deodorized fish meat, functional fish protein concentrate and their incorporation to various products. Fish meal and oil. Dry reduction and wet

reduction methods. Fish maws, shark leather, Chitin, chitosan, fish glue, fish gelatin, isinglass, pearl essence, shark fin rays, beach de mer, and biochemical and pharmaceutical products.

Unit iv **5**

Utilization of seaweeds: agar agar, algin, carrageenan. Diversified fish products: battered and braided products-fish finger, fish cutlet, fish wafer, and fish soup powder etc and imitation products. Value addition, HACCP in safe products production.

Unit v : Skill based 20%

1. Foundations of Research

Meaning, Objectives, Motivation: Research Methods *vs*Methodology, Types of Research: Analytical *vs*Descriptive, Quantitative *vs* Qualitative, Basic *vs* Applied

2. Research Design

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

3. Teaching Methodology

Materials development and syllabus design,Teacher education and critical pedagogy, Technology and language teaching, Sociocultural Theory of language learning, Classroom Management.

Total 45

B. Sc. Part III Semester- VI

FISHERIES

PAPER-VII

BZFT- 601 Marine Ecology and Fisheries

Theory: 36 hrs. (45 lectures of 48 minutes)

Marks-50 (Credits: 02)

Unit I

Marine habitat **8**

a. Physical parameters

b. Chemical parameters

c. Classification of habitat

d) Physico-chemical parameters of estuary

Oceanographic instruments: **6**

i. Grabs

ii. Dredges

iii. Sacchi disc

iv. Water samplers

v. Reversing and non-reversing thermometers

Plankton net

Unit II

Brackish water habitat fisheries: 4

a) Definition of Brackish water

b) Definition of estuary

Types of estuary

Characteristics and fauna of: **11**

i. Rocky shore

ii. Muddy shore

iii. Sandy shore

Fauna in estuary -Permanent and migratory.

Unit III

Study of fisheries Crustacean Fisheries Molluscan fisheries 12

Study of fisheries of commercial importance with respect to Bionomics, food, feeding and economic importance of :

a. Mackerel

b. Pomfret

c. Bombay duck

d. Sardine

Unit IV

Capture and culture fisheries: 4

Milk fish, Tilapia, Perches, Anguilla, Hilsa, Asian sea bassand Mullet.

i.Feed Manufacture : feed formulation and processing.

ii. On farm feed manufacture.

iii. Commercial feed manufacture.

iv .Feed storage.

v. Supplymentary feed.

vi. Feeding methods and scheduling.

vii. Feed performance and economics.

B. Sc. Part III Semester- VI

FISHERIES

PAPER-VIII

BZFT- 602 Fish Pathology and Fishery Technology

Theory: 36 hrs. (45 lectures of 48 minutes)

Marks-50 (Credits: 02)

Unit I

A Fishing gear technology 6

I Materials used in fishing gears

ii Properties and numbering system of gear making fibres

iii Net making by braiding and cutting , mounting of webbing, rigging of various gears, principles of mending. knots, hitches and bends. iv. Purse seine

B . Fish spoilage: 4

a) Criteria for freshness of fish b) Post mortem changes i. Rigor mortis ii. Bacterial spoilage iii. Chemical spoilage

Unit II

Fish pathology: 13

Aetiology, symptoms and control measures for the following:

i. Viral diseases

ii. Bacterial diseases

iii. Fungal diseases

iv. Protozoan diseases

v. Epizootic ulcerative syndrome(EUS)

vi. Worm diseases

vii. Crustacean diseases

B) Fish Marketing **6**

i. Definition.

ii. Marketing channel

iii .risk of fish marketing.

iv. Co.operative society in aquaculture (public sector in aquaculture).

v. FFDA organization

Unit III

A) Fish preservation and processing techniques Principles and methods with reference to: 6

viii. a. Refrigeration and freezing b. Drying c. Salting d. Smoking e. Canning

B) Fish products and by-products: 5

a. Fish body oil b. Fish liver oil c. Fish meal d. Isinglass e. Fish protein concentrate f. Fish glue g. Fish manure

Total 45

B. Sc. Part III

BZFP 603

FISHERY PRACTICAL-I

Marks-50 (Credits: 02)

Practical II(based on papers VII and VIII)

Unit I

1 Estimation of fish blood chloride. 5

2. Total RBCs and WBCs counts.
   Estimation of hemoglobin offish

Unit II

1. Determination of fecundity 5
2. Determination of moisture content of fish.
3. Ovo- diametry & study of stages of maturity.
   Gonadosomatic index (GSI) and conditioning Factor

Unit III

1. Fish morphometry – Length-weight relationship 5
2. Study of ecological adaptations of the following:
   a. *Mytilus*
   b. *Echeneis*
   c. Exocoetus
   d. *Anguilla*
   e. Pleuronectes
3. Study of oceanographic instruments.
4. Observations of mortality with respect to:
   a. Stocking density
   b. Use of different chemicals – LC50
5. Study of Economic importance of:
   a. Bombay duck
   b. Mackerel
   c. Pomfret
   d.Sardine

Unit IV

1. Study of pathological condition of fish and treatment. 4
   a. Fin rot
   b. Argulus
   c. Nematode
2. Study of knots , hitches &bends.
3. Organoleptic tests for freshness of fish.

Visit to sea shore/ fish market /processing factories.

A report of visit be submitted at the time of university practical examination

B. Sc. Part III Semester- VI
FISHERIES
PAPER-
New B -Fish nutrition .
Theory: 36 hrs. (45 lectures of 48 minutes)
Marks-50 (Credits: 02)

Unit I

Nutritional physiology 10

Principles of nutrition, Adaptations to various types of feeding in finfish, crustaceans and mollusks; Mechanism of food capture, food ingestion and role of feeding stimulants; Digestion assimilation and conversion of nutrients; Roles of gut microbes in digestion; Nutritional bioenergetics in finfish and shellfish.

Unit II

Nutritional requirements 12

Gross protein requirements; Nitrogen balance; Essential and non-essential amino acids and their quantitative requirements; Protein quality and sources; Lipid – their functions; Essential fatty acids; phospholipid & sterol requirements; Protein sparing action of lipids; Negative aspects of lipids; Carbohydrates – their sources and utilization; Gross energy requirements; Factors altering energy requirements; Water and fat soluble vitamins

; Deficiency and hyper dosage syndromes; antivitamin factors; Mineral requirements, importance of minerals; recommended dietary allowances; deficiency and hyper dosage syndromes.

Unit III

Management of feeding 10

Feeding strategies. Feeding equipments. Feeding rate and frequency. Recording of feeding and monitoring water quality. Feeding of commercially important species like milk fish, tilapia, carp, sea bass, tiger shrimp and Macrobrachium rosenbergi.

Unit IV

Nutritional diseases 5

Nutritional diseases of cultured varieties of fishes, mollusks and crustaceans and control measures.

Unit v : Skill based 20% 8

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B. Sc. Part III Semester- VI

FISHERIES

PAPER-

New C - Fishery education, extension and economics of aquaculture .

Theory: 36 hrs. (45 lectures of 48 minutes)

Marks-50 (Credits: 02)

. **Unit – I :** . Fisheries training and education in India : Training Institutes, Universities, Research Organisations, etc. 2. Institutional funding to fisheries and aquaculture sector

Unit – II : . Socio-economic conditions of fishermen and fish farmers 4. Fishermen Co-operative Societies

Unit – III : . Role of government agencies – Role of NABARD and other central government agencies in the upliftment of fisher folk. Role of state government agencies in various fishery activities – Loans and credits, policies . Integrated coastal zone management, ocean policy, role of NGO's CRZ

Unit – IV : . Economics of aquaculture 9. Economic viability, data requirement, analysis of data 10. Financial and economic feasibility, risk and insurance .

Unit v : Skill based 20%

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