



ADIKAVI NANNAYA UNIVERSITY:: RAJAHMAHENDRAVARAM
B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

UG ROGRAM (4 Y ears Honors)
CBCS - 2020-21

SUBJECT
ZOOLOGY



Syllabus and Model Question Papers



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1. Resolutions of the Board of Studies

Meeting held on 22-01-2010 Time: 10:00
AMAt: N.T.R Convention Centre,
Adikavi Nannaya University, Rajamahendravaram

Agenda:

1. Adoption of revised-common program structure and revising/updating course-wise syllabi (in the prescribed format) as per the guidelines issued by APSCHE
2. Adoption of regulations on scheme of examination and marks/grading system of the UG program
3. Preparation of Model question papers in prescribed format
4. List of equipment / software requirement for each lab/practical
5. Eligibility of student for joining the course
6. Eligibility of faculty for teaching the course
7. Any specific instructions to the teacher/paper-setter/student/ chief-superintendent/ paper-evaluator
8. List of paper-setters/paper evaluator with phone, email-id in the prescribed format

Members present:

1. Dr P. Vijaya Nirmala
2. Dr. N. Srinivas
3. Dr. P. Anil Kumar
4. Dr. M. Tejomurthy
5. Dr. P. Raghava Kumari
6. K. Babu
7. Dr. P.S.CH. P Deepika Rani
8. Lakshmi Kantham
9. D. Mounika



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UG Program (4 years Honors) Structure (CBCS)

2020-21 A. Y., onwards
BACHLOR OF SCIENCE

(3rd and 4th year detailed design will be followed as per APSCHE GUIDELINES)

Subjects/ Semesters		I		II		III		IV		V		VI			
		H/W	C	H/W	C										
Languages															
English		4	3	4	3	4	3								
Language (H/T/S)		4	3	4	3	4	3								
Life Skill Courses		2	2	2	2	2+2	2+2								
Skill Development Courses		2	2	2+2	2+2	2	2								
Core Papers															
M-1	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1						
M-2	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1						
M-3	C1 to C5	4+2	4+1	4+2	4+1	4+2	4+1	4+2	4+1						
M-1	SEC (C6,C7)									4+2	4+1				
M-2	SEC (C6,C7)									4+2	4+1				
M-3	SEC (C6,C7)									4+2	4+1				
Hrs/ W (Academic Credits)		30	25	32	27	32	27	36	30	36	30	0	12	4	4
Project Work															
Extension Activities (Non Academic Credits)															
NCC/NSS/Sports/Extra Curricular									2						
Yoga							1		1						
Extra Credits															
Hrs/W (Total Credits)		30	25	32	27	32	28	36	33	36	30	0	12	4	4

M= Major; C= Core; SEC: Skill Enhancement Courses



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Marks & Credits distribution: UG-Sciences

Sl. No	Course type	No. of courses	Each course teaching Hrs/wk	Credit for each course	Total credits	Each course evaluation			Total marks
						Conti-Assess	Univ-exam	Total	
1	English	3	4	3	9	25	75	100	300
2	S.Lang	3	4	3	9	25	75	100	300
3	LS	4	2	2	8	0	50	50	200
4	SD	4	2	2	8	0	50	50	200
5	Core/SE -I	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -II	5+2	4+2	4+1	35	25	75+50	150	1050
	Core/SE -III	5+2	4+2	4+1	35	25	75+50	150	1050
6	Summer-Intern	2		4	8		100	200	200
7	Internship/ Apprentice/ on the job training	1		12	12		200	200	200
		38			159				4550
8	Extension Activities (Non Academic Credits)								
	NCC/NSS/Sports/ Extra Curricular			2	2				
	Yoga			2	1	2			
	Extra Credits								
	Total	40			142				



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DETAILS OF PAPER TITLES & CREDITS

Sem	Course no.	Course Name	Course type (T/L/P)	Hrs./Week (Arts/Commerce:5 & Science:4+2)	Credits (Arts/Commerce:4 & Science:4+1)	Max. Marks Cont/Internal/Mid Assessment	Max. Marks Sem - end Exam	
I	1	Animal Diversity – IBiology of Non- Chordates	T	4	4	25	75	
		Animal Diversity – IBiology of Non- Chordates Lab	L	2	1	-	50	
II	2	Animal Diversity –IIBiology of Chordates	T	4	4	25	75	
		Animal Diversity –II Biology of ChordatesLab	L	2	1	-	50	
III	3	Cell biology, Genetics, Molecular Biology & Evolution	T	4	4	25	75	
		Cell biology, Genetics, Molecular Biology & Evolution Lab	L	2	1	-	50	
IV	4	Physiology, CellularMetabolism & Embryology	T	4	4	25	75	
		Physiology, Cellular Metabolism & Embryology Lab	L	2	1	-	50	
	5	Immunology & Animal Biotechnology	T	4	4	25	75	
		Immunology & Animal BiotechnologyLab	L	2	1	-	50	
V	6A	Sustainable Aquaculture Management	T	4	4	25	75	
		Sustainable Aquaculture Management Lab	L	2	1	-	50	
	7A	Post Harvest Technologyof Fish And Fisheries	T	4	4	25	75	
		Postharvest Technology of Fish And Fisheries Lab	L	2	1	-	50	
	OR							
	6B	Live Stock Management-I (Biology of Dairy Animals)	T	4	4	25	75	
		Live Stock Management-I Lab (Biology of Dairy Animals)	L	2	1	-	50	
	7B	Live Stock Management -II (Dairy Production and Management)	T	4	4	25	75	
Live Stock Management -II Lab (Dairy Production and Management)		L	2	1	-	50		
OR								
6C	Poultry Management- I (Poultry Farming)	T	4	4	25	75		
	Poultry Management- I Lab (Poultry Farming)	L	2	1	-	50		



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7C	Poultry Management- II (Poultry Production and Management)	T	4	4	25	75
	Poultry Management- II Lab (Poultry Production and Management)	L	2	1	-	50
OR						
6D	Seri Culture -I***	T	4	4	25	75
	Seri Culture -I Lab	L	2	1	-	50
7D	Seri Culture -II	T	4	4	25	75
	Seri Culture -II Lab	L	2	1	-	50

Note: *Course type code: T: Theory, L: Lab, P: Problem solving

Note 1: For Semester–V, for the domain subject **ZOOLOGY**, any one of the three pairs of SECs shall be chosen as courses 6 and 7, i.e., 6A & 7A or 6B & 7B or 6C & 7C or 6D&7D. The pair shall not be broken (ABC allotment is random, not on any priority basis).

Note 2: One of the main objectives of Skill Enhancement Courses (SEC) is to inculcate field skills related to the domain subject in students. The syllabus of SEC will be partially skill oriented. Hence, teachers shall also impart practical training to students on the field skills embedded in the syllabus citing related real field situations.

Note 3: To insert assessment methodology for Internship/ on the Job Training/Apprenticeship under the revised CBCS as per APSICHE Guidelines.

- **First internship (After 1st Year Examinations):** Community Service Project. To inculcate social responsibility and compassionate commitment among the students, the summer vacation in the intervening 1st and 2nd years of study shall be for Community Service Project (the detailed guidelines are enclosed).
- **Credit For Course: 04**
- **Second Internship (After 2nd Year Examinations):** Apprenticeship / Internship / on the job training / In-house Project / Off-site Project. To make the students employable, this shall be undertaken by the students in the intervening summer vacation between the 2nd and 3rd years (the detailed guidelines are enclosed).
- **Credit For Course: 04**
- **Third internship/Project work (6th Semester Period):**
During the entire 6th Semester, the student shall undergo Apprenticeship / Internship / On the Job Training. This is to ensure that the students develop hands on technical skills which will be of great help in facing the world of work (the detailed guidelines are enclosed).
- **Credit For Course:12**



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- a. Proposed combination subjects: **Chemistry, Botany, Zoology.**
- b. Student eligibility for joining in the course: **10+2 Intermediate qualification Bi.P.C Vocational courses MLT, MPHW (Nursing, PT Phytotherapy)**
- c. Faculty eligibility for teaching the course: **PG, M.Phil, PhD in Zoology**
- d. List of Proposed Skill enhancement courses with syllabus, if any
- e. Any newly proposed Skill development/Life skill courses with draft syllabus and required resources
- f. Required instruments/software/ computers for the course (Lab/Practical course-wise required i.e., for a batch of 15 students)

Sem. No.	Lab/Practical Name	Names of Instruments/Software/ computers required with specifications	Brand Name	Qty Required
I	Animal Diversity – I Biology of Non-Chordates			
II	Animal Diversity –II Biology of Chordates			
III	Cell biology, Genetics, Molecular Biology & Evolution			
IV	Physiology, Cellular Metabolism & Embryology			
IV	Immunology & Animal Biotechnology			

- g. List of Suitable levels of positions eligible in the Govt/Pvt organizations
 Suitable levels of positions for these graduates either in industry/govt organization like. technical assistants/ scientists/ school teachers., clearly define them, with reliable justification

S.No	Position	Company/ Govt organization	Remarks	Additional skills required, if any
1	School Teachers	Private		
2	Technical Assistant	Private		

- h. List of Govt. organizations / Pvt companies for employment opportunities or internships or projects

S.No	Company/ Govt organization	Position type	Level of Position			
1						
2.						

- i. Any specific instructions to the teacher /paper setters/Exam-Chief Superintendent



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2. Program objectives, outcomes, co-curricular and assessment methods

BA/BCOM/BSc/BVoc	ZOOLOGY
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1. Aim and objectives of UG program in Subject:
2. Learning outcomes of Subject (in consonance with the Bloom's Taxonomy):
3. Recommended Skill enhancement courses: (Titles of the courses given below and details of the syllabus for 4 credits (i.e., 2 units for theory and Lab/Practical) for 5 hrs class- cum- lab work
4. Recommended Co-curricular activities:(Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

A. Measurable:

1. Assignments on:
2. Student seminars (Individual presentation of papers) on topics relating to:
3. Quiz Programmes on:
4. Individual Field Studies/projects:
5. Group discussion on:
6. Group/Team Projects on:

B General

1. Collection of news reports and maintaining a record of paper-cuttings relating to topics covered in syllabus
 2. Group Discussions on:
 3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers
 4. Any similar activities with imaginative thinking.
5. Recommended Continuous Assessment methods:



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4. Details of course-wise Syllabus

BSc/BA/BCom	Subject (Semester: I)	Credits:
Paper: 1	Title of Course	Hrs/Wk:

1. Aim and objectives of Course (Title of the course/paper):
6. Learning outcomes of Course (in consonance with the Bloom's Taxonomy):
7. Detailed Syllabus: (Five units with each unit having 12 hours of class work)

Unit-1

Unit-2

Unit-3

Unit-4

Unit-5

Recommended Text Books:

Reference books:

8. Details of Lab/Practical/Experiments/Tutorials syllabus:

Recommended Text books:

Recommended Reference books:

9. Recommended Co-curricular activities:(Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)

A. Measurable:

1. Assignments on:
2. Student seminars (Individual presentation of papers) on topics relating to:
3. Quiz Programmes on:
4. Individual Field Studies/projects:
5. Group discussion on:
6. Group/Team Projects on:



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B. General

1. Collection of news reports and maintaining a record of paper-cuttings relating to topics covered in syllabus
2. Group Discussions on:
3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers
4. Any similar activities with imaginative thinking.

10. Recommended Continuous Assessment methods:

5. MODEL QUESTION PAPER (Sem-end. Exam)

B.Sc	Subject (Semester: I)	Max. Marks:
Paper: 1	(Coursetitle)	3Hrs

B.Sc	Subject (Semester: V)	Credits:
Paper: 5	(Course title)	Hrs/Wk:

1. Aim and objectives of Course (Title of the course):
2. Learning outcomes of Course (in consonance with the Bloom's Taxonomy):
3. Detailed Syllabus: Five units (i.e., each unit having 12 hours of class work)

Unit-1

Unit-2

Unit-3

Unit-4

Unit-5

Recommended Text Books:

Reference books:

4. Details of Lab/Practical/Experiments/Tutorials syllabus:

Recommended Text books:

Recommended Reference books:



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5. Recommended Co-curricular activities:(Co-curricular Activities should not promote copying from text book or from others' work and shall encourage self/independent and group learning)
 - A. Measurable:
 1. Assignments on:
 2. Student seminars (Individual presentation of papers) on topics relating to:
 3. Quiz Programmes on:
 4. Individual Field Studies/projects:
 5. Group discussion on:
 6. Group/Team Projects on:
 - B. General
 1. Collection of news reports and maintaining a record of paper-cuttings relating to topics covered in syllabus
 2. Group Discussions on:
 3. Watching TV discussions and preparing summary points recording personal observations etc., under guidance from the Lecturers
 4. Any similar activities with imaginative thinking.
6. Recommended Continuous Assessment methods:



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B. Sc	Semester: I	Credits:4
Paper: 1	Animal Diversity – Biology of Nonchordates	Hrs/Wk:4

Course Outcomes: By the completion of the course the graduate should able to –

- Describe general taxonomic rules on animal classification
- Classify Protozoa to Coelenterata with taxonomic keys
- Classify Phylum Platyhemninthes to Annelida phylum using examples from parasitic adaptation and vermin composting
- Describe Phylum Arthropoda to Mollusca using examples and importance of insects and Molluscans
- Describe Echinodermata to Hemichordate with suitable examples and larval stages in relation to the phylogeny

Learning objectives

- To understand the taxonomic position of protozoa to helminthes.
- To understand the general characteristics of animals belonging to protozoa to hemichordate.
- To understand the structural organization of animal's phylum from protozoa to hemichordate.
- To understand the origin and evolutionary relationship of different phyla from protozoa to hemichordate.
- To understand the origin and evolutionary relationship of different phylum from annelids to hemichordates.

UNIT I:

Principles of Taxonomy – Binomial nomenclature – Rules of nomenclature Whittaker's five kingdom concept and classification of Animal Kingdom.

Phylum Protozoa: General Characters and classification of protozoa up to species level with suitable examples Locomotion, nutrition and reproduction in Protozoan's *Elphidium* (type study)

UNIT II:

Phylum Porifera: General characters and classification up to species level with suitable examples Skelton in Sponges Canal system in sponges

Phylum Coelenterate: General characters and classification up to species level with suitable examples Mutagenesis in *Obelia*, Polymorphism in coelenterates, Corals and coral reefs formation

Phylum Ctenophore: General Characters and Evolutionary significance (affinities)

UNIT III:

Phylum Platy helminthes: General characters and classification up to species level with suitable examples Life cycle and pathogen city of *Fasciola hepatica* Parasitic Adaptations in helminthes

Phylum Nemathelminthes: General characters and classification up to species level with suitable examples Life cycle and pathogen city of *Ascaris lumbricoides*

UNIT IV:

Phylum Annelida: General characters and classification up to species level with suitable examples *Hirudinaria granulosa*- External characters, digestive system, excretory system and reproductive system, Evolution of Coelom and Coelomoducts, Vermiculture - Scope, significance, earthworm species, processing, Vermicompost, economic importance of vermin compost



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Phylum Arthropoda :General characters and classification up to species level with suitable examples Prawn- External characters, appendages, respiratory system and circulatory system Vision and respiration in Arthropoda, Metamorphosis in Insects *Peripatus*- Structure and affinities Social Life in Bees and Termites

UNIT V:

Phylum Mollusca: General characters and classification up to species level with suitable examples ,Pearl formation in Pelecypoda, Sense organs in Mollusca,Torsion in gastropods

Phylum Echinodermata: General characters and classification up to species level with suitable examples, Water vascular system in starfish, Larval forms of Echinodermata

Phylum Hemichordate: General characters and classification up to species level with suitable examples, *Balanoglossus* - Structure and affinities

Co-curricular activities (suggested)

- Preparation of chart/model of phylogenic tree of life, 5-kingdom classification, *Elphidium* life cycle etc.
- Visit to Zoology museum or Coral island as part of Zoological tour
- Charts on life cycle of *Obelia*, polymorphism, spongespicules
- Clay models of canal system in sponges
- Preparation of charts on life cycles of *Fasciola* and *Ascaris*
- Visit to adopted village and conducting awareness campaign on diseases, to people as part of Social Responsibility.
- Plaster-of-Paris or Thermocol model of *Periapert's*
- Construction of a vermicompost in each college, manufacture of manure by students and donating to local farmers
- Models of compound eye, bee hive and termitarium (termitaria) by students
- Visit to apiculture centre and short-term training as part of apprenticeship programme of the govt. of Andhra Pradesh
- Chart on pearl forming layers using clay orThermocol
- Visit to a pearl culture rearing industry/institute
- Live model of water vascular system
- Phylogeny chart on echinoderm larvae and their evolutionary significance
- Preparation of charts depicting the feeding mechanism, 3coeloms, tornarialarvaetc., of *Balanoglossus*.

REFERENCE BOOKS:

1. L.H. Hyman '*The Invertebrates*' Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. E.L. Jordan and P.S. Verma '*Invertebrate Zoology*' S. Chand and Company.
4. R.D. Barnes '*Invertebrate Zoology*' by: W.B. Saunders CO.,1986.
5. Barrington. E.J.W., '*Invertebrate structure and Function*' by ELBS.
6. P.S. Dhama and J.K. Dhama. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. Parker, T.J. and Haswell '*A text book of Zoology*' by, W.A., Mac Millan Co.London.
8. Barnes, R.D. (1982). *Invertebrate Zoology*, VEdition"



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B. Sc	Semester: I	Credits:1
Paper: 1(L)	Animal Diversity – Biology of Nonchordates Lab	Hrs/Wk:2

Learning Outcomes:

- To understand the importance of preservation of museum specimens
- To identify animals based on special identifying characters
- To understand different organ systems through demo or virtual dissections
- To maintain a neat, labeled record of identified museum specimens

Syllabus:

1. Study of museum slides / specimens / models (Classification of animals up to orders)

Protozoa: Amoeba, Paramecium, Paramecium Binary fission and Conjugation, Vorticella, Entamoebahistoltytica, Plasmodium vivax

Porifera: Sycon, Spongilla, Euspongia, Sycon- T.S & L.S, Spicules, Gem mule

Coelenterata: Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatulav.

Platyhelminthes: Planaria, Fasciola hepatica, Fasciolalarval forms – Miracidium, Redia, Cercaria, Echinococcusgranulosus, Taeniasolium, Schistosomahaematobiumvii.

Nemathelminthes: Ascaris (Male & Female), Drancunculus, Ancylostoma, Wuchereria

Annelida: Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva

Arthropoda: Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Periapt's, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male & female Anopheles and Culex, Mouthparts of Housefly and Butterfly. xiii.

Mollusca: Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva

Echinodermata: Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Ante don, Bipinnaria larva

Hemichordata: Balanoglossus, Tornaria larva.

2. Dissections:

Prawn: Appendages, Digestive system, Nervous system, Mounting of Statocyst

Insect Mouth Parts

Laboratory Record work shall be submitted at the time of practicalamination

An “**Animal album**” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to differentsets of students for thispurpose

Computer - aided techniques should be adopted or show virtual dissections

REFERENCE MANUALS:

1. Practical Zoology- Invertebrates S.S.Lal
2. Practical Zoology - Invertebrates P.S.Verma
3. Practical Zoology - Invertebrates K.P.Kurl
4. Ruppert and Barnes (2006) Invertebrate Zoology, 8th Edition, Holt SaundersInternational Edition



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B. Sc	Semester: II	Credits:4
Paper: 2	Animal Diversity – Biology of Chordates	Hrs/Wk:4

Course Outcomes: By the completion of the course the graduate should able to -

- Describe general taxonomic rules on animal classification of chordates
- Classify Protochordata to Mammalian with taxonomic keys
- Understand Mammals with specific structural adaptations
- Understand the significance of dentition and evolutionary significance
- Understand the origin and evolutionary relationship of different phyla from Prochordata to mammalian.

Learning objectives

- To understand the animal kingdom.
- To understand the taxonomic position of Protochordata to Mammalian.
- To understand the general characteristics of animals belonging to Fishes to Reptilians.
- To understand the body organization of Chordata.
- To understand the taxonomic position of Protherian mammals.

UNIT I:

General characters and classification of Chordata upto species level Protochordata- Salient features of Cephalochordate, Structure of *Branchiostoma* Affinities of Cephalochordate. Salient features of Urochordata Structure and life history of *Herdmania* Retrogressive metamorphosis –Process and Significance.

UNIT II:

Cyclostomata, General characters, Comparison of *Petromyzon* and *Myxine* Pisces: General characters and classification of Fishes upto species level *Scoliodon*: External features, Digestive system, Respiratory system, Structure and function of Heart, Structure and functions of the Brain. Migration in Fishes Types of Scales Dipnoi.

UNIT III:

General characters of Amphibian Classification of Amphibian upto species level with examples. *Ranahexadactyla*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and functions of the Brain

Reptilia: General characters of Reptilia, Classification of Reptilia upto species level with examples

Calotes: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain Identification of Poisonous and non-poisonous snakes and Skull in reptiles.

UNIT IV:

Aves: General characters and classification of Aves upto species level *Columba livia*: External features, Digestive system, Respiratory system, Structure and function of Heart, structure and function of Brain Migration in Birds Flight adaptation in birds.

UNIT V:

General characters of Mammalian Classification of Mammalian upto species level with examples Comparison of Prototherians, Metatherians and Eutherians Dentition in mammals



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Co-curricular activities (suggested)

- Preparation of charts on Chordate classification (with representative animal photos) and retrogressive metamorphosis
- Thermocol or Clay models of Herdmania and Amphioxus
- Visit to local fish market and identification of local cartilaginous and bony fishes
- Maintaining of aquarium by students
- Thermocol model of fish heart and brain
- Preparation of slides of scales of fishes
- Visit to local/nearby river to identify migratory fishes and prepare study notes
- Preparation of Charts on above topics by students (Eg: comparative account of vertebrate heart/brain/lungs, identification of snakes etc.)
- Collecting and preparation of Museum specimens with dead frogs/snakes/lizards etc., and/or their skeletons
- Additional input on types of snake poisons and their antidotes (student activity).
- Collection of bird feathers and submission of report on Plumology
- Taxidermic preparation of dead birds for Zoology museum
- Map pointing of prototherian and metatherian mammals
- Chart preparation for dentition in mammals.

REFERENCE BOOKS:

1. J.Z. Young, 2006. The life of vertebrates. (The Oxford University Press, New Delhi). 646 pages. Reprinted
2. Arumugam, N. Chordate Zoology, Vol. 2. Saras Publication. 278 pages. 200 figs.
3. A.J. Marshall, 1995. Textbook of zoology, Vertebrates. (The McMillan Press Ltd., UK). 852 pages. (Revised edition of Parker & Haswell, 1961).
4. M. Ekambaranatha Ayyar, 1973. A manual of zoology. Part II. (S. Viswanathan Pvt. Ltd., Madras).
5. P.S. Dhama & J.K. Dhama, 1981. Chordate zoology. (R. Chand & Co.). 550 pages.
6. Gurdarshan Singh & H. Bhaskar, 2002. Advanced Chordate Zoology. Campus Books, 6 Vols., 1573 pp., tables, figs.
7. A.K. Sinha, S. Adhikari & B.B. Ganguly, 1978. Biology of animals. Vol. II. Chordates. (New Central Book Agency, Calcutta). 560 pages.
8. R.L. Kotpal, 2000. Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut). 632 pages.
9. E.L. Jordan & P.S. Verma, 1998. Chordate zoology. (S. Chand & Co.). 1092 pages.
10. G.S. Sandhu, 2005. Objective Chordate Zoology. Campus Books, vii, 169 pp.
11. Sandhu, G.S. & H. Bhaskar, H. 2004. Textbook of Chordate Zoology. Campus Books, 2 vols., xx, 964 p., figs.
12. Veena, 2008. Lower Chordata. (Sonali Publ.), 374 p., tables, 117 figs.



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B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester: II	Credits:1
Paper: 2(L)	Animal Diversity – Biology of Chordates Lab	Hrs/Wk:2

Learning Outcomes:

- To understand the Taxidermic and other methods of preservation of chordates
- To identify chordates based on special identifying characters
- To understand internal anatomy of animals through demo or virtual dissections, thus directing the student for “empathy towards the fellow living beings”
- To maintain a neat, labelled record of identified museum specimens

Observation of the Following Slides / Spotters / Models

- Protochordata: *Herdmania*, *Amphioxus*, *Amphioxus* T.S through pharynx.
- Cyclostomata: *Petromyzon* and *Myxine*.
- Pisces: *Pristis*, *Torpedo*, *Hippocampus*, *Exocoetus*, *Echeneis*, *Labeo*, *Catla*, *Claries*, *Channa*, *Anguilla*.
- Amphibian: *Ichthyophis*, *Amblystoma*, *Axolotl larva*, *Hyla*,
- Reptilia: *Draco*, *Chameleon*, *Uromastix*, *Testudo*, *Trionyx*, *Russels viper*, *Naja*
- Krait, *Hydrophis*, *Crocodile*.
- Aves: *Psittacula*, *Eudynamis*, *Bubo*, *Alcedo*.
- Mammalian: *Ornithorhynchus*, *Pteropus*, *Funambulus*.

Dissections-

1. *Scoliodon* IX and X, Cranial nerves
2. *Scoliodon* Brain
3. Mounting of fish scales

Note: 1. Dissections are to be demonstrated only by the faculty or virtual.

2. Laboratory Record work shall be submitted at the time of practical examination.

REFERENCE BOOKS:

1. S.S.Lal, Practical Zoology –Vertebrate
2. P.S.Verma, A manual of Practical Zoology – Chordata



B. Sc	Semester: III	Credits:4
Paper: 3	Cell Biology, Genetics, Molecular Biology and Evolution	Hrs/Wk:4

Course Outcomes:

The overall course outcome is that the student shall develop deeper understanding of what life is and how it functions at cellular level. This course will provide students with a deep knowledge in Cell Biology, Animal Biotechnology and Evolution and by the completion of the course the graduate shall be able to–

- To understand the basic unit of the living organisms and to differentiate the organisms by their cell structure.
- Describe fine structure and function of plasma membrane and different cell organelles of eukaryotic cell.
- To understand the history of origin of branch of genetics, gain knowledge on heredity, interaction of genes, various types of inheritance patterns existing in animals
- Acquiring in-depth knowledge on various aspects of genetics involved in sex determination, human karyotyping and mutations of chromosomes resulting in various disorders.
- Understand the central dogma of molecular biology and flow of genetic information from DNA to proteins.
- Understand the principles and forces of evolution of life on earth, the process of evolution of new species and apply the same to develop new and advanced varieties of animals for the benefit of the society.

Learning Objectives

- To understand the origin of cell and distinguish between prokaryotic and eukaryotic cell.
- To understand the role of different cell organelles in maintenance of life activities.
- To provide the history and basic concepts of heredity, variations and gene interaction.
- To enable the students distinguish between polygenic, sex-linked, and multiple allelic modes of inheritance.
- To acquaint student with basic concepts of molecular biology as to how characters are expressed with a coordinated functioning of replication, transcription and translation in all living beings.
- To provide knowledge on origin of life, theories and forces of evolution.
- To understand the role of variations and mutations in evolution of organisms.

UNIT I:

Cell Biology: Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma Electron microscopic structure of animal cell. Plasma membrane –Models and transport functions of plasma membrane. Structure and functions of Golgi complex, Endoplasmic Reticulum and Lysosomes Structure and functions of Ribosomes, Mitochondria, Nucleus, Chromosomes

(**Note: 1. General pattern of study of each cell organelle** – Discovery, Occurrence, Number, Origin, Structure and Functions with suitable diagrams)

2. Need not study cellular respiration under mitochondrial functions)

UNIT II:

Genetics-I: Mendel's work on transmission of traits Gene Interaction – Incomplete Dominance, Codominance, Lethal Genes Polygene's (General Characteristics & examples); Multiple Alleles (General Characteristics and Blood group inheritance Sex determination (Chromosomal, Genic Balance, Hormonal, Environmental and Haplo- diploidy types of sex determination) Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

UNIT III:

Genetics - II: Mutations & Mutagenesis, Chromosomal Disorders (Autosomal and Allosomal) Human Genetics – Karyotyping, Pedigree Analysis(basics) Basics on Genomics and Proteomics



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UNIT IV:

Molecular Biology: Central Dogma of Molecular Biology Basic concepts of-

1. DNA replication – Overview (Semi-conservative mechanism, Semi- discontinuous mode, Origin & Propagation of replication fork)
2. Transcription in prokaryotes – Initiation, Elongation and Termination, Post-transcriptional modifications(basics)
3. Translation – Initiation, Elongation and Termination Gene Expression in prokaryotes (Lac Operon); Gene Expression in eukaryotes

UNIT V:

Origin of life Theories of Evolution: Lamarckism, Darwinism, Germ Plasm Theory, Mutation Theory Neo-Darwinism: Modern Synthetic, Theory of Evolution, Hardy-Weinberg Equilibrium Forces of Evolution: Isolating mechanisms, Genetic Drift, Natural Selection, Speciation

Co-curricular activities (Suggested)

- Model of animal cell
- Working model of mitochondria to encourage creativity among students
- Photo album of scientists of cell biology
- Charts on plasma membrane models/cell organelles
- Observation of Mendelian / Non-Mendelian inheritance in the plants of college botanical garden or local village as a student study project activity
- Observation of blood group inheritance in students, from their parents and grandparents
- Karyo typing and preparation of pedigree charts for identifying diseases in family history
- Charts on chromosomal disorders
- Charts on central dogma/lac Operon/genetic code
- Model of semi-conservative model of DNA replication
- Model of tRNA and translation mechanism
- Power point presentation of transcription or any other topic by students
- Draw geological time scale and highlight important events along the timeline
- Chart on industrial melanism to teach directed selection, Darwin's finches to teach genetic drift, collection of data on weight of children born in primary health centres to teach stabilizing selection etc.

REFERENCE BOOKS:

1. Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell 'Molecular Cell Biology' W.H.Freeman and company New York.
2. Cell Biology by DeRobertis
3. Bruce Alberts, Molecular Biology of the Cell
4. Rastogi, Cytology
5. Varma & Aggarwal, Cell Biology
6. C.B. Pawar, Cell Biology
7. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
8. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
9. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
10. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
11. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co.
12. Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing



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13. Molecular Biology by freifelder
14. Instant Notes in Molecular Biology by Bios scientific publishers and Viva BooksPrivate Limited
15. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and BartlettPublishers
16. Campbell, N. A. and Reece J. B. (2011). Biology. IX Edition, Pearson, Benjamin,Cummings.
17. Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associates.
18. Minkoff, E. (1983). Evolutionary Biology. Addison-Wesley.
19. James D. Watson, Nancy H. Hopkins 'Molecular Biology of the Gene'
20. Jan M. Savage. Evolution, 2nd ed, Oxford and IBH Publishing Co., New Delhi.
21. Gupta P.K..'Genetics



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B. Sc	Semester: III	Credits:1
Paper: 3(L)	Cell Biology, Genetics, Molecular Biology and Evolution Lab	Hrs/Wk:2

Learning Objectives:

Acquainting and skill enhancement in the usage of laboratory microscope Hands-on experience of different phases of cell division by experimentation Develop skills on human Karyo typing and identification of chromosomal disorders

To apply the basic concept of inheritance for applied research

To get familiar with phylogeny ad geological history of origin & evolution of animals

I. Cell Biology

1. Preparation of temporary slides of Mitotic divisions with onion root tips
2. Observation of various stages of Mitosis and Meiosis with prepared slides
3. Mounting of salivary gland chromosomes of *Chironomus*

II. Genetics

1. Study of Mendelian inheritance using suitable examples and problems.
2. Problems on blood group inheritance and sex linked inheritance.
3. Study of human Karyo types (Down's syndrome, Edwards, syndrome, Patausyndrome, Turner's syndrome and Klinefelter syndrome).

III. Evolution

1. Study of fossil evidences.
2. Study of homology and analogy from suitable specimens and pictures.
3. Phylogeny of horse with pictures.
4. Study of Genetic Drift by using examples of Darwin's finches(pictures).
5. Visit to Natural History Museum and submission of report.

REFERENCE BOOKS:

1. Burns GW. 1972. *The Science of Genetics. An Introduction to Heredity*. Mac MillanPubl.Co.Inc.
2. Gardner EF. 1975. *Principles of Genetics*. John Wiley & Sons, Inc. NewYork.
3. Harth and Jones EW. 1998. *Genetics – Principles and Analysis*. Jones and BarHett Publ.Boston.
4. Levine L. 1969. *Biology of the Gene*.Toppan.
5. Pedder IJ. 1972. *Genetics as a Basic Guide*. W. Norton & Company,Inc.
6. Rastogi VB. 1991. *A Text Book of Genetics*.KedarNath Ram Nath Publications, Meerut, Uttar Pradesh,India.
7. Rastogi VB. 1991. *Organic Evolution*.KedarNath Ram Nath Publications,Meerut,Uttar Pradesh,India.
8. Stahl FW. 1965. *Mechanics of Inheritance*. Prentice-Hall.
9. White MJD. 1973. *Animal Cytology and Evolution*. Cambridge Univ.Press.



B. Sc	Semester: IV	Credits:4
Paper: 4	Animal Physiology, Cellular Metabolism and Embryology	Hrs/Wk:4

Course Outcomes:

This course will provide students with a deep knowledge in Physiology, Cellular metabolism and Molecular Biology and by the completion of the course the graduate shall able to –

- Understand the functions of important animal physiological systems including digestion, cardio-respiratory and renal systems.
- Understand the muscular system and the neuro-endocrine regulation of animal growth, development and metabolism with a special knowledge of hormonal control of human reproduction.
- Describe the structure, classification and chemistry of Biomolecules and enzymes responsible for sustenance of life in living organisms
- Develop broad understanding the basic metabolic activities pertaining to the catabolism and anabolism of various Biomolecules
- Describe the key events in early embryonic development starting from the formation of gametes upto gastrula ion and formation of primary germ layers.

Learning Objectives

- To achieve a thorough understanding of various aspects of physiological systems and their functioning in animals.
- To instil the concept of hormonal regulation of physiology, metabolism and reproduction in animals.
- To understand the disorders associated with the deficiency of hormones
- To demonstrate a thorough knowledge of the intersection between the disciplines of Biology and Chemistry.
- To provide insightful knowledge on the structure and classification of carbohydrates, proteins, lipids and enzymes
- To demonstrate an understanding of fundamental biochemical principles such as the function of Biomolecules, metabolic pathways and the regulation of biochemical processes
- To make students gain proficiency in laboratory techniques in biochemistry and orient them to apply the scientific method to the processes of experimentation and hypothesis testing.

UNIT I:

Animal Physiology -I: Process of digestion and assimilation, Respiration - Pulmonary ventilation, transport of oxygen and CO₂, (Note: Need not study cellular respiration here), Circulation - Structure and functioning of heart, Cardiac cycle, Excretion - Structure and functions of kidney urine formation, counter current Mechanism

UNIT II:

Animal Physiology -II: Nerve impulse transmission - Resting membrane potential, origin and propagation of action potentials along myelinated and non-myelinated nerve fibers. Muscle contraction - Ultra structure of muscle, molecular and chemical basis of muscle contraction. Endocrine glands - Structure, functions of hormones of pituitary, thyroid, parathyroid, adrenal glands and pancreas, Hormonal control of reproduction in a mammal

UNIT III:

Cellular Metabolism – I(Biomolecules) Carbohydrates - Classification of carbohydrates. Structure of glucose Proteins - Classification of proteins. General properties of amino acids Lipids - Classification of lipids. Enzymes: Classification and Mechanism of Action

UNIT IV:

Cellular Metabolism –II: Carbohydrate Metabolism - Glycolysis, Krebs cycle, Electron Transport Chain, Glycogen metabolism, Gluconeogenesis, Lipid Metabolism – Synthesis of fatty acids, β -oxidation of palmitic acid Protein metabolism - Transamination, Deamination and Urea Cycle



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UNIT V:

Embryology: Gametogenesis Fertilization, Types of eggs Types of cleavages, Development of Frog upto formation of primary germ layers

Co-curricular activities (Suggested)

- Chart on cardiac cycle, human lung, kidney/nephron structure etc.
- Working model of human / any mammalian heart.
- Chart of sarcomere/location of endocrine glands in human body
- Chart affixing of photos of people suffering from hormonal disorders
- Student study projects such as identification of incidence of hormonal disorders in the local primary health centre, studying the reasons thereof and measures to curb or any other as the lecturer feels good in nurturing health awareness among students
- Chart on structures of Biomolecules/types of amino acids (essential and non- essential) Chart preparation by students on Glycolysis / Krebs's cycle/urea cycle etc.
- Model of electron transport chain
- Preparation of models of different types of eggs in animals
- Chart on frog embryonic development, fate map of frog blastula, cleavage etc.

REFERENCE BOOKS:

1. Eckert H. *Animal Physiology: Mechanisms and Adaptation*. W.H. Freeman & Company.
2. Flory E. *An Introduction to General and Comparative Animal Physiology*. W.B. Saunders Co., Philadelphia.
3. Goel KA and Satish KV. 1989. *A Text Book of Animal Physiology*, Rastogi Publications, Meerut, U.P.
4. Hoar WS. *General and Comparative Physiology*. Prentice Hall of India, New Delhi.
5. Lehninger AL, Nelson and Cox. *Principles of Biochemistry*. Lange Medical Publications, New Delhi.
6. Prosser CL and Brown FA. *Comparative Animal Physiology*. W.B. Saunders Company, Philadelphia.
7. *Developmental Biology* by Balinsky
8. *Developmental Biology* by Gerard Karp
9. *Chordate embryology* by Varma and Agarwal
10. *Embryology* by V.B. Rastogi
11. Austen CR and Short RV. 1980. *Reproduction in Mammals*. Cambridge University Press.
12. Gilbert SF. 2006. *Developmental Biology*, 8th Edition. Sinauer Associates Inc., Publishers, Sunderland, USA.
13. Longo FJ. 1987. *Fertilization*. Chapman & Hall, London.
14. Rastogi VB and Jayaraj MS. 1989. *Developmental Biology*. Kedara Nath Ram Nath Publishers, Meerut, Uttar Pradesh.
15. Schatten H and Schatten G. 1989. *Molecular Biology of Fertilization*. Academic Press, New York.



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B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester: IV	Credits:1
Paper: 4(L)	Animal Physiology, Cellular Metabolism and Embryology Lab	Hrs/Wk:2

Learning Objectives:

- Identification of an organ system with histological structure
- Deducing human health based on the information of composition of blood cells
- Demonstration of enzyme activity *invitro*
- Identification of various Biomolecules of tissues by simple colorimetric methods and also quantitative methods
- Identification of different stages of earl embryonic development in animals

I. Animal physiology

1. Qualitative tests for identification of carbohydrates, proteins and fats
2. Study of activity of salivary amylase under optimum conditions
3. T.S. of duodenum, liver, lung, kidney, spinal cord, bone and cartilage
4. Differential count of human blood

II. Cellular metabolism

1. Estimation of total proteins in given solutions by Lowry's method.
2. Estimation of total carbohydrate by Anthrone method.
3. Qualitative tests for identification of ammonia, urea and uric acid
4. Protocol for Isolation of DNA in animal cells

III. Embryology

1. Study of T.S. of testis, ovary of a mammal
2. Study of different stages of cleavages (2, 4, 8 cell stages)
3. Construction of fate map of frog blastula

REFERENCE BOOKS:

- Harper's Illustrated Biochemistry
- Cell and molecular biology: Concepts & experiments. VI Ed. John Wiley &sons. Inc.
- Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.
- Laboratory techniques by Plummer



B. Sc	Semester: IV	Credits:4
Paper: 5	Immunology and Animal Biotechnology	Hrs/Wk:4

Course Outcomes:

This course will provide students with a deep knowledge in immunology, genetics, embryology and ecology and by the completion of the course the graduate shall able to –

- To get knowledge of the organs of Immune system, types of immunity, cells and organs of immunity.
- To describe immunological response as to how it is triggered (antigens) and regulated(antibodies)
- Understand the applications of Biotechnology in the fields of industry and agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.
- Get familiar with the tools and techniques of animal biotechnology.

Learning Objectives

- To trace the history and development of immunology
- To provide students with a foundation in immunological processes
- To be able to compare and contrast the innate versus adaptive immune systems and humoral versus cell-mediated immune responses
- Understand the significance of the Major His to compatibility Complex in terms of immune response and transplantation
- To provide knowledge on animal cell and tissue culture and their preservation
- To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
- To explain *in vitro* fertilization, embryo transfer technology and other reproduction manipulation methodologies.
- To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.
- To understand principles of animal culture, media preparation.

UNIT I:

Immunology – I (Overview of Immune system): Introduction to basic concepts in Immunology, Innate and adaptive immunity, Vaccines and Immunization programme, Cells of immune system, Organs of immune system

UNIT II: Immunology – II (Antigens, Antibodies, MHC and Hypersensitivity)

Antigens: Basic properties of antigens, B and T cell epitomes, happens and adjuvant; Factors influencing immunogenicity

Antibodies: Structure of antibody, Classes and functions of antibodies Structure and functions of major his to compatibility complexes, Exogenous and Endogenous pathways of antigen presentation and processing Hypersensitivity – Classification and Types

UNIT III:

Techniques: Animal Cell, Tissue and Organ culture media: Natural and Synthetic media, Cell cultures: Establishment of cell culture (primary culture, secondary culture, types of cell lines; Protocols for Primary Cell Culture); Established Cell lines (common examples such as MRC, HeLa, CHO, BHK, Vero); Organ culture; Cryopreservation of cultures

Stem cells: Types of stem cells and applications, Hybridoma Technology: Production & applications of Monoclonal antibodies (mAb)



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UNIT IV:

Applications of Animal Biotechnology: Genetic Engineering: Basic concept, Vectors, Restriction Endonucleases and Recombinant DNA technology

Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral-mediated gene delivery

Transgenic Animals: Strategies of Gene transfer; Transgenic - sheep, fish; applications Manipulation of reproduction in animals: Artificial Insemination, *In vitro* fertilization, super ovulation, Embryo transfer, Embryo cloning

UNIT V:

PCR: Basics of PCR.

DNA Sequencing: Sanger's method of DNA sequencing- traditional and automated sequencing (2hrs)

Hybridization techniques: Southern, Northern and Western blotting DNA fingerprinting: Procedure and applications

Applications in Industry and Agriculture: Fermentation: Different types of Fermentation and Downstream processing;

Agriculture: Monoculture in fishes, polyploidy in fishes

Co-curricular activities (suggested)

- Organizing awareness on immunization importance in local village in association with NCC and NSS teams.
- Charts on types of cells and organs of immune system
- Student study projects on aspects such as – identification of allergies among students (hypersensitivity), blood groups in the class (antigens and antibodies duly reported) etc., as per the creativity and vision of the lecturer and students
- Visit to research laboratory in any University as part of Zoological tour and exposure and/ or hands-on training on animal cell culture.
- Visit to biotechnological laboratory in University or any central/state institutes and create awareness on PCR, DNA finger printing and blot techniques or Visit to a fermentation industry or Visit to a local culture pond and submit report on culture of fishes etc.

REFERENCE BOOKS:

1. Immunology by Ivan M. Riott
2. Immunology by Kubey
3. Sree krishna V. 2005. *Biotechnology –I, Cell Biology and Genetics*. New Age International Publ. New Delhi, India.



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B. Sc	Semester: IV	Credits:1
Paper: 5(L)	Immunology and Animal BiotechnologyLab	Hrs/Wk:2

Learning Objectives:

- a. Acquainting student with immunological techniques vis-à-vis theory taught in the classroom
- b. Interconnect the theoretical and practical knowledge of immunity with the outer world for the development of a healthier life.
- c. Demonstrate basic laboratory skills necessary for Biotechnology research
- d. Promoting application of the lab techniques for taking up research in higher studies

I. Immunology

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of
 - a. ELISA
 - b. Immune electrophoresis

II. Animal biotechnology

1. DNA quantification using DPA Method.
2. Techniques: Western Blot, Southern Hybridization, DNA Fingerprinting
3. Separation, Purification of biological compounds by paper, Thin-layer and Column chromatography
4. Cleaning and sterilization of glass and plastic wares for cell culture.
5. Preparation of culture media.

REFERENCE BOOKS:

1. Immunology Lab Biology 477 Lab Manual; Spring 2016 Dr. Julie Jameson
2. Practical Immunology A Laboratory Manual; LAP LAMBERT AcademicPublishing
3. Manual of laboratory experiments in cell biology by Edward
4. Laboratory Techniques by Plummer



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MODEL QUESTION PAPERS(Semester - End)
B .Sc DEGREE EXAMINATIONS
SEMESTER - I

Course - 1:ANIMAL DIVERSITY – BIOLOGY OF NONCHORDATES

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

Draw labeled diagrams wherever necessary

1. Binomial nomenclature
2. Whittaker's concept
3. Hexactinellida
4. Polymorphism
5. Parasitic adaptations
6. Coelom and coelomic ducts
7. Cephalic appendages in Prawn
8. Pearl formation

Section - B

Answer ALL the following:

5x10=50

Draw labeled diagrams wherever necessary

9. a. Describe the structure and life history of *Elphidium*.
OR
b. Classify the phylum Protozoa with suitable examples up to species level.
10. a. Describe various types of canal systems in sponges.
OR
b. Write an essay on corals and coral reef formation.
11. a. Write in detail about the life history of *Fasciola hepatica*.
OR
b. Discuss the life cycle of *Ascaris lumbricoides*. Add a note on its Pathogenicity.
12. a. Explain the process and economic importance of vermiculture.
OR
b. Describe the structure of *Peripatus*. Add a note on its affinities.
13. a. Give an account on water vascular system in star fish.
OR
b. Write in detail about the structure and affinities of *Balanoglossus*.



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MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - II

Course - 2: ANIMAL DIVERSITY – BIOLOGY OF CHORDATES

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

Draw labeled diagrams wherever necessary

1. *Amphioxus*
2. Placoidscale
3. Quillfeather
4. Prototheria
5. Anadromousmigration
6. *Draco*
7. Emu
8. Apoda

Section - B

Answer ALL the following:

5x10=50M

Draw labeled diagrams wherever necessary

9. a. Explain the life history of *Herdmania*
OR
b. Explain the origin and general characters of chordates
10. a. Compare the characters of *Petromyzon* and *Myxine*
OR
b. Describe the structure of heart in *Scoliodon*
11. a. Describe the brain of *Ranahexadactyla*
OR
b. Explain the external features of *Calotes*
12. a. Write an essay on flight adaptations in birds
OR
b. Explain the respiratory system of *Columba livia*
13. a. Compare the characters of Metatheria and Eutheria
OR
b. Write an essay on dentition in mammals



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MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - III

Course - 3: CELL BIOLOGY, GENETICS, MOLECULAR BIOLOGY AND EVOLUTION

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

1. Prokaryotic cell
2. Golgi complex
3. Polygenes
4. Multiple alleles
5. Mutations
6. Karyotyping
7. Lac operon concept
8. Genetic drift

Section - B

Answer ALL the following:

5x10=50

Draw labeled diagrams wherever necessary

9. a. Describe the ultra structure of animal cell
OR
b. Explain the structure of mitochondria. Add a note on its functions.
10. a. Write an essay on gene interactions
OR
b. Discuss sex linked inheritance.
11. a. What are chromosomal disorders? Explain various types of autosomal and allosomal disorders
OR
12. a. Give an account of DNA replication.
OR
b. Explain the mechanism of Prokaryotic transcription.
13. a. An essay on modern synthetic theory of evolution.
OR
b. Define isolation. Discuss various isolating mechanisms.



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B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - IV

Course - 4: ANIMAL PHYSIOLOGY, CELLULAR METABOLISM AND EMBRYOLOGY

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

1. Assimilation
2. Cardiac cycle
3. Ultra structure of muscle
4. Pancreas
5. Structure of glucose
6. Lipids
7. Gluconeogenesis
8. Types of eggs

II. Section - B

Answer ALL the following:

5x10=50

Draw labeled diagrams wherever necessary

9. a. Explain the process of digestion.

OR

- b. Describe the structure and function of heart

10. a. Give an account of nerve impulse transmission.

OR

- b. Write an essay on the hormonal control of reproduction in mammals

11. a. Write an essay on the classification of carbohydrates

OR

- b. Classify the enzymes. Discuss the mechanism of enzyme action.

12. a. Write an account on Kreb's cycle.

OR

- b. Explain B- oxidation of palmitic acid

13. a. Discuss the process of fertilization.

OR

- b. Write an essay on gameto genesis.



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MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - IV

Course - 5: IMMUNOLOGY AND ANIMAL BIOTECHNOLOGY

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25

Draw labeled diagrams wherever necessary

1. Vaccines
2. Primary lymphoid organs
3. Hapten
4. Hypersensitivity
5. Natural media
6. Cell lines
7. Endo nucleases
8. Polyploidy in fishes

Section - B

Answer ALL the following:

5x10=50

Draw labeled diagrams wherever necessary

9. a. Define immunity. Write in detail about innate immunity.

OR

- b. Explain various cells of immune system

10. a. Describe the structure of antibody. Add a note on their functions.

OR

- b. Describe the structure of MHC molecules. Discuss their role in the mechanism of exogenous and endogenous pathway of antigen processing and presentation

11. a. Write an essay on different types of stem cells and their applications

OR

- b. Explain the production and applications of monoclonal antibodies.

12. a. Write an account on recombinant DNA technology.

OR

- b. Write an essay on transgenic animals

13. a. Explain hybridization techniques.

OR

- b. Write an essay on PCR.



B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:4
Paper: 6A	Sustainable Aquaculture Management	Hrs/Wk:4

Learning Outcomes:

Students at the successful completion of this course will be able to

- Evaluate the present status of aquaculture at the Global level and National level
- Classify different types of ponds used in aquaculture
- Demonstrate induced breeding of carps
- Acquire critical knowledge on commercial importance of shrimps
- Identify fin and shell fish diseases

II. Syllabus: (Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

UNIT I:

- 1.1 Present status of Aquaculture – Global and National scenario
- 1.2 Major cultivable species for aquaculture: freshwater, brackish water and marine.
- 1.3 Traditional, extensive, modified extensive, semi-intensive and intensive cultures of fish and shrimp.
- 1.4 Design and construction of fish and shrimp farms

UNIT II:

- 2.1 Functional classification of ponds – head pond, hatchery, nursery ponds
- 2.2 Functional classification of ponds -rearing, production, stocking and quarantine ponds
- 2.3 Need of fertilizer and manure application in culture ponds
- 2.4 Physio-chemical conditions of soil and water optimum for culture (Temperature, depth, turbidity, light, water, PH, BOD, CO₂ and nutrients)

UNIT III:

- 3.1. Induced breeding in fishes
- 3.2. Culture of Indian major carps: Pre-stocking management (Dewatering, drying, ploughing/desilting; redators, weeds and algal blooms and their control, Liming and fertilization)
- 3.3. Culture of Indian major carps - Stocking management
- 3.4. Culture of Indian major carps - post-stocking management

UNIT IV:

- 4.1 Commercial importance of shrimp & prawn
- 4.2 Macrobrachium rosenbergii- biology, seed production.
- 4.3 Culture of L. vannamei – hatchery technology and culture practices
- 4.4 Mixed culture of fish and prawns

UNIT V:

- 5.1 Viral diseases of Fin Fish & shell fish
- 5.2 Fungal diseases of Fin & Shell fish
- 5.3 Bacterial diseases of Finfish & Shell fish
- 5.4 Prophylaxis in aquaculture



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REFERENCES:

1. Pillay TVR & M.A.Dill, 1979. Advances in Aquaculture. Fishing News Books Ltd., London
2. Stickney RR 1979. Principles of Warm Water Aquaculture. John Wiley & Sons Inc.1981
3. Boyd CE 1982. Water Quality Management for Pond Fish Culture. Elsevier Scientific Publishing Company.
4. Bose AN et.al. 1991. Costal Aquaculture Engineering. Oxford & IBH Publishing Company Pvt. Ltd.

Web Links:

1. http://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6708e/x6708e06.htm
2. http://aquaticcommons.org/1666/1/Better-Practice3_opt.pdf
3. <https://www.notesonzoology.com/india/fishery/fish-diseases-symptoms-and-control-fishery/871>



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B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:1
Paper: 6A	Sustainable Aquaculture Management Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

- Identify the characters of Fresh water cultivable species
- Estimate physico chemical characteristics of water used for aquaculture
- Examine the diseases of fin and shell fish
- Suggest measures to prevent diseases in aquaculture

Practical (Laboratory) Syllabus: (30hrs) (Max.50Marks)

1. Fresh water Cultivable species any (Fin & Shell Fish Specimens – Observation of morphological characters by observation and drawings)-5
2. Brackish water cultivable species (Fin & Shell fish- Specimens- Observation of Morphological Character by observing drawing) -5
3. Hands on training on the use of kits for determination of water quality in aquaculture (DO, Salinity, pH, Turbidity- Testing kits to be used for the estimation of various parameters/ Standard procedure can be demonstrated for the same)
4. Demonstration of Hypophysation(Procedure of hypophysation to be demonstrated in the practical lab with any edible fish as model)
5. Viral diseases of Fin & Shell Fish (Observation of his to pathological slides / Charts/ Models of viral pathogens in fin/ shell fish – one edible specimen can be used for observation of same in the laboratory)
6. Bacterial diseases of Fin & Shell Fish (Observation of his to pathological slides / Charts/ Models of Bacterial pathogens in fin/ shell fish – One edible specimen can be used for observation of same in the laboratory)
7. Fungal diseases of Fin & Shell Fish (Observation of his to pathological slides / Charts/ Models of Bacterial pathogens in fin/ shell fish – One edible specimen can be used for observation of same in the laboratory)

LAB REFERENCES

1. Boyd CE 1982. Water Quality Management for Pond Fish Culture. Elsevier Scientific Publishing Company
2. http://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6708e/x6708e06.htm
3. http://aquaticcommons.org/1666/1/Better-Practice3_opt.pdf
4. <https://www.notesonzoology.com/india/fishery/fish-diseases-symptoms-and-control-fishery/871>

Web resources suggested by the teacher concerned and the college librarian including reading material



Co-Curricular Activities

a) Mandatory:(Student training by teacher in field skills: Total 15 hrs., Lab:10 + field 05)

1. For Teacher: Training of students by the teacher in laboratory/field for not less than 15 hours on Breeding- Induced breeding in carps -hatchery technology of L. Vennami- Farming techniques- disease diagnostic techniques—concepts –Demonstration @ any aqua laboratory
2. For Student: Students shall (individually) visit a Hatchery/Farm/ Aqua diagnostic center and make careful observations of the process method and implements- protocols and report on the same in 10 pages hand written Fieldwork/Project work Report.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work: Title page, student details, index page, details of place visited, observations made, findings and acknowledgements.
5. (IE).Unit tests.

b) Suggested Co-Curricular Activities

1. Preparation of Model/Charts of Cultivable species of fin fish shell fish
2. Preparation of Model/Chart of Ideal fish Pond- with the standards prescribed.
3. Observation of aquaculture activities in their area (Observation of any activity related to aquaculture in the vicinity of the college/village)
4. Preparation of Model – charts of Fin /Shell fish Diseases with eco-friendly material.
5. Assignments, Group discussion, Seminar, Quiz, Collection of Material, Video preparation etc., Invited lecture



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MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - V (Skill Enhancement Course - Elective)

Course - 6A: Sustainable Aquaculture Management

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

1. History of Aquaculture
2. Brackish water aquaculture
3. Culture species of Sea weeds
4. Organic Manures
5. Water Quality
6. Fungal diseases of Fin fish
7. Post stocking Management
8. Procurement of seed for stalking

Section - B

Answer ALL the following:

5x10=50M

9. a. What is the current status of aquaculture at global and National level?
OR
b. Describe the layout of fish farm.
10. a. Explain the construction and management methods of nursery ponds.
OR
b. Write a detailed account on the need of fertilizer and manure application in culture ponds.
- 11 a. Write an essay on Induced breeding
OR
b. Discuss the culture of Indian Major Carps.
- 12 a. Give an account of commercial importance of Shrimp culture.
OR
b. Write an essay on mixed culture of fishes.
13. a. Describe the viral diseases of shell fishes.
OR
b. Write about bacterial diseases of Fin fishes.



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B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:4
Paper: 7A	Postharvest Technology of Fish and Fisheries	Hrs/Wk:4

Learning Outcomes:

Students at the successful completion of this course will be able to

- Identify the types of preservation methods employed in aquaculture
- Choose the suitable Processing methods in aquaculture
- Maintain the standard quality control protocols laid down in aqua industry
- Identify the best Seafood quality assurance system

Syllabus: Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

UNIT I: Handling and Principles of fish Preservation

- 1.1 Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortis and spoilage), spoilage in marine fish and freshwater fish.
- 1.2 Principles of preservation – cleaning, lowering of temperature, rising of temperature, denudation, use of salt, use of fish preservatives, exposure to low radiation of gamma rays.

UNIT II: Methods of fish Preservation

- 2.1 Traditional methods - sun drying, salt curing, pickling and smoking.
- 2.2. Advanced methods – chilling or icing, refrigerated sea water, freezing, canning, irradiation and Accelerated Freeze drying (AFD).

UNIT III: Processing and preservation of fish and fish by-products

- 3.1 Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein concentrate, fish chowder, fish cake, fish sauce, fish salads, fish powder, pet food from trash fish, fish manure.
- 3.2 Fish by-products – fish glue, Using glass, chitosan, pearl essence, shark fins, fish Leather and fish maws.

UNIT IV: Sanitation and Quality control

- 4.1 Sanitation in processing plants - Environmental hygiene and Personal hygiene in processing plants.
- 4.2 Quality Control of fish and fishery products – pre-processing control, control during processing and control after processing.

UNIT V: Quality Assurance, Management and Certification

- 5.1. Seafood Quality Assurance and Systems: Good Manufacturing Practices (GMPs); Good Laboratory Practices (GLPs); Standard Operating Procedures (SOPs); Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.
- 5.2 National and International standards – ISO 9000: 2000 Series of Quality Assurance System, Codex Alimentarius.

REFERENCES:

1. Santharam R, N Sukumaran and P Natarajan 1987. A manual of aquaculture, Oxford- IBH, NewDelhi
2. Lakshmi Prasad's, Fish Processing Technology 2012, Arjun Publishing House
3. Dr Sunitha Rai, Fish Processing Technology, 2015, Random Publications
4. Safety and Quality Issues in Fish Processing (Woodhead Publishing Series in Food Science, Technology and Nutrition) by H A Bremner
5. K.A Mahanthy, Innovations in Fishing and Fish Processing Technologies, January 2021



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Web Resources:

1. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=145743>
2. https://ecourses.icar.gov.in/e-Learningdownload3_new.aspx?Degree_Id=03



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B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:1
Paper: 7A	Postharvest Technology of Fish and Fisheries Lab	Hrs/Wk:2

Learning Outcomes: On successful completion of this practical course, student shall be able to:

- Identify the quality of aqua processed products.
- Determine the quality of fishery products by observation
- Analyze the protocols of aqua processing methods

Practical (Laboratory) Syllabus:

1. Evaluation of fish/ fishery products for organoleptic, chemical and microbial quality.
2. Preparation of dried, cured and fermented fish products
For detailed procedure method visit sites:
3. Examination of salt, protein, moisture in dried / cured products
4. Examination of spoilage of dried / cured fish products, marinades, pickles, sauce.
5. Preparation of isinglass, collagen and chitosan from shrimp and crab shell.
6. Developing flow charts and exercises in identification of hazards – preparation of hazard analysis worksheet
7. Corrective action procedures in processing of fish- flow chart- work sheet preparation

(** Refer the following web sites for complete procedure method and estimations of abovelisted practicals)

REFERENCES:

1. Dr Sunitha Rai, Fish Processing Technology, 2015, Random Publications
2. https://ecourses.icar.gov.in/e-Learning/download3_new.aspx?Degree_Id=03
3. <https://vikaspedia.in/agriculture/fisheries/post-harvest-and-marketing/processing-in-fisheries/fermented-products>
4. <https://krishi.icar.gov.in/jspui/bitstream/123456789/20500/1/Fermentation%20technology%20for%20fish.pdf>
5. <http://jebas.org/00200620122014/Abujam%20et%20al%20JEBAS.pdf>
6. https://krishi.icar.gov.in/jspui/bitstream/123456789/20770/1/Training%20Manual_Hygienic%20drying%20and%20packing%20of%20fish.pdf
7. https://krishi.icar.gov.in/jspui/bitstream/123456789/20770/1/Training%20Manual_Hygienic%20drying%20and%20packing%20of%20fish.pdf
8. https://krishi.icar.gov.in/jspui/bitstream/123456789/20770/1/Training%20Manual_Hygienic%20drying%20and%20packing%20of%20fish.pdf
9. https://agritech.tnau.ac.in/fishery/fish_byproducts.html
10. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5352841/>
11. <http://www.fao.org/3/i1136e/i1136e.pdf>
12. <http://www.fao.org/3/x5989e/X5989e01.htm#What%20is%20sensory%20assessment>
13. <http://www.fao.org/3/x5989e/X5989e01.htm#What%20is%20sensory%20assessment>

Web resources suggested by the teacher concerned and the college librarian including reading material

Co-Curricular Activities

a) Mandatory: (Lab/field training of students by teacher (lab 10 + field 05):

1. For Teacher: Training of students by the teacher in laboratory/field for not less than 15 hours on various steps of post-harvest techniques of fishes, on the advanced techniques in post-harvest technology – Training of students on other employability skills in the Post-harvest sector of Aquaculture Industry-like Processing, Packing, marketing of processed aqua products.
2. For Student: Students shall (individually) visit - Any fish/shrimp Processing Plant/Packing industry and make observations on post harvesting techniques and submit a brief handwritten Fieldwork/Project work Report with pictures and data /survey in 10 pages.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements*
5. (IE): Unit tests,



b) Suggested Co-Curricular Activities

1. Observation of fish/shrimp processing plants – visit web sites of processing companies and record the details of that Unit
2. Interaction with local fishermen to know the method of preservation and details with the available traditional technology
3. Collection of web resources on the Quality assurance, quality control measures in Aqua Industries- cross checking the standards during the visit to any processing units.
4. Assignments, Seminar, Group discussion. Quiz, Collection of Material, Invited lecture, Video preparation etc.,



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MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - V (Skill Enhancement Course - Elective)

Course - 7A: Postharvest Technology of Fish and Fisheries

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

1. Storage and transport of fresh fish
2. Sun drying
3. Canning
4. Fish glue
5. Preparation of Agar
6. Fish liver oil
7. Quality control of fishery products
8. GMP's and SOP's

Section - B

Answer ALL the following:

5x10=50M

9. a. Write an essay on Principles of Post harvesting technology.
OR
b. Explain the spoilage in marine and fresh water fish.
- 10 a. Describe the Traditional methods of Fish preservation.
OR
b. Write about advanced methods of fish preservation.
11. a. Enlist the important fish products.
OR
b. Give an account of fish by-products.
- 12 a. Discuss the sanitation in processing plants of Post harvesting technology.
OR
b. Write an essay on quality control of fish and fishery products.
- 13 a. Explain the sea food quality assurance and systems.
OR
b. Discuss the national and international standards of quality assurance system ISO 9000 : 2000 series of quality assurance system.



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B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:4
Paper: 6B	Live Stock Management-I (Biology of Dairy Animals)	Hrs/Wk:4

Learning Outcomes:

Students at the successful completion of the course will be able to

- Select the suitable breeds of livestock for rearing
- Relate the anatomy of udder with letdown of milk
- Identify and manipulate the reproductive behavior of cattle
- Inspect the economics of dairy farming
- Apprise the various breeding techniques employed in live stock

Syllabus: (Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

UNIT I: Livestock census; Breeds of Dairy cattle, Buffaloes and Goats. Indigenous, Exotic and Crossbred Cattle breeds

UNIT II: Anatomy of Udder; Development of udder; Lacto genesis and Galactopoises; Letdown of milk.

UNIT III: Artificial insemination; Oestrous cycle; Symptoms of heat in cows and buffaloes. Conception, Pregnancy diagnosis in cattle. Multi ovulation and embryo transfer technique. Cloning.

UNIT IV: Economic traits of Dairy cattle. Methods of selection of dairy animals.

UNIT V: Systems of Dairy cattle breeding. Inbreeding, out breeding, Cross breeding, Grading up. Breeding systems (Cross breeding of cattle and Grading up of buffaloes).

REFERENCES:

1. Textbook of Animal Husbandry-GC Benarjee
2. Handbook of Animal Husbandry –ICAR Edition
3. Principles and practices of Dairy Farm–Jagdish Prasad

Web resources:

1. <http://ecoursesonline.iasri.res.in/course/index.php?categoryid=42>
2. <https://vetsebooks.blogspot.com/p/e-books.html>
3. <https://www.basu.org.in/study-materials/veterinary-science/>
4. <https://vikaspedia.in/agriculture/livestock/cattle-buffalo/breeds-of-cattle-buffalo>

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B. Sc	Semester: V (Skill Enhancement Course - Elective)	Credits:1
Paper: 6B	Live Stock Management-I Lab (Biology of Dairy Animals)	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to

1. Examine the points of dairy cow
2. Understand the behavioral changes of cow during the reproductive period
3. Differentiate the merits and demerits of cross breeds in cattle

Practical (Laboratory) Syllabus:(30hrs)**(Max.50Marks)**

1. Points dairy cow. (Explanation with observation of charts- Model evaluation to be performed by the student in the laboratory)
2. Identification of different breeds of dairy cattle and buffaloes.(Observation of Charts of breeds in the laboratory- at least 3 breeds should be identified by the students in their locality with video, photo)
3. Male and female reproductive systems of cow – Model/ Chart (Student has to draw a labeled diagram of the male and female reproductive systems of cow – acquire skill to identify the parts).
4. Symptoms of heat in cow (Study and Understanding the physiological symptoms during heat).
5. Artificial in semi nation (Flow chart of implements – Procedure- precautions)
6. Pregnancy diagnosis in cattle.
7. Study comparative merits of cows and buffaloes; zebu and cross bred cows (Examination of merits)

Lab References:

1. Principles and practices of Dairy Farm–Jadish Prasad
2. Dairy cow points: <https://www.icar.org/Guidelines/05-Conformation-Recording.pdf>
3. Pregnancy test protocol:
<https://cgspace.cgiar.org/bitstream/handle/10568/109408/Milk%20testing%20lab%20protocol.pdf?sequence=1&isAllowed=y>

Web resources suggested by the teacher concerned and the college librarian including reading material

Co-Curricular Activities

a) **Mandatory:**(Lab/ field training of students by teacher :(lab:10 + filed: 05):

1. For Teacher: Training of students by the teacher in laboratory/field for not less than 15 hours on principles and practices of dairy industry- breeds –artificial insemination- reproductive behavior of cows etc. as per the syllabus above.
2. For Student: Students shall individually visit to any of the nearby cattle rearing centers/ veterinary hospital/Raithu Bharosa Kendra and make observations of the procedure and quality enhancement activities and submit a handwritten Fieldwork/Project work Report in 10 pages.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements*
5. (IE)Unit tests,

b) Suggested Co-Curricular Activities

1. Collection of various cattle breed images from the web to prepare a album
2. Visit the sites of Veterinary colleges in India and preparation of brief report on the videos and content/ employment details
3. Sketch a model dairy farm with details
4. Invited lecture and presentation on related topics by experts
Seminar, Assignment, Group discussion. Quiz, Collection of Material, Invited lecture, Video preparation etc



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MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - V (Skill Enhancement Course - Elective)

Course - 6B: Live Stock Management-I
(Biology of Dairy Animals)

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

1. Exotic Cattle breeds
2. Breeds of goats
3. Galactopoises
4. Oestrous cycle
5. Cloning
6. Symptoms of heat in cows
7. Grading up of buffaloes
8. Out Breeding

Section - B

Answer ALL the following:

5x10=50M

9. a. Write an essay on breeds of dairy cattle.
OR
b. Give an account of different types of Crossbreeds in Cattle.
10. a. Describe the anatomy of udder and its development.
OR
b. Write an account on Lactogenesis.
11. a. Discuss in detail about artificial insemination
OR
b. Describe Multi ovulation and Embryo transfer technology.
12. a. Explain various selection methods of dairy animals.
OR
b. Write an essay on economic traits of dairy cattle.
- 13 a. Explain Inbreeding.
OR
b. Write about cross breeding systems of cattle.



B. Sc	Semester: V (Skill Enhancement Course - Elective)	Credits:4
Paper: 7B	Live Stock Management -II (Dairy Production And Management)	Hrs/Wk:4

Learning Outcomes:

Students at the successful completion of the course will be able to

- Identify and suggest the suitable housing system for the dairy farming
- Understand management practices for the dairy farming
- Learn the process of milk pasteurization
- Prepare cream from milk

Syllabus: (Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

UNIT I:

Systems of Housing of Dairy cattle- Loose Housing and Conventional Dairy Barns. Drawing of layouts for dairy cattle dwellings; Criteria for selecting site for establishing Dairy farm buildings; Water requirement of dairy animals.

UNIT II:

Management of different classes of Dairy animals- Milk producing animals, pregnant animals dry animals, heifers and calves. Management practices for Dairy farm; Identification, Dehorning, Castration, Deworming, Vaccination, Disinfection, and Milking.

UNIT III:

- a. Pasteurization of milk: Definition, objects of pasteurization, objections to pasteurization, Principles of heat exchange. Methods of pasteurization: LTLT, HTST and Uperization.
- b) Sterilization of milk. Homogenization: Factors influencing homogenization

UNIT IV:

Market milk: Toned milk, double toned milk, Reconstituted milk, Standardized milk and full cream milk– Standards and methods of manufacture.

UNIT V:

Cream: Types of cream, composition, methods of cream separation, gravity and centrifugal methods, types of cream separators, factors affecting fat losses in skim milk and fat percentage in cream.

REFERENCES:

1. Textbook of Animal Husbandry-G C Benarjee
2. Handbook of Animal Husbandry –ICAR Edition
3. Principles and practices of Dairy Farm–Jagdish Prasad
4. <http://ecoursesonline.iasri.res.in/course/index.php?categoryid=42>
5. <https://vetsebooks.blogspot.com/p/e-books.html>
6. <https://www.basu.org.in/study-materials/veterinary-science/>
7. <https://vikaspedia.in/agriculture/livestock/cattle-buffalo/breeds-of-cattle-buffalo>



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B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:1
Paper: 7B	Live Stock Management -II Lab (Dairy Production And Management)	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

- Design a model dairy farm layout
- Understand procedure of milk pasteurization at milk processing centers
- Identify various important management practices in dairy farming

Practical (Laboratory) Syllabus : (30hrs) (Max.50Marks)

1. Dairy Farm layout (In the laboratory student has to sketch a dairy farm with all its components)
2. Identification of cows (students have to identify the breeds of cows from the images/charts – have to identify any two breeds in the vicinity of the college/ their locality).
3. Dehorning of calves : (Method - protocol- precautions)
4. Castration of bulls (Method – Apparatus- Time-importance)
5. Deworming of dairy cattle : (Schedule – method- benefits)
6. Pasteurization of milk (Batch Method- procedure- Observation)
7. Sterilization of milk (In bottle sterilization- procedure – protocol)
8. Cream separation (By gravity method- procedure- hands on experiment)

Lab References

1. Handbook of Animal Husbandry –ICAR Edition
2. Dairy farm layout : <https://www.youtube.com/watch?v=dmukHUEUvKc>
3. Dehorning procedure : <http://www.omafra.gov.on.ca/english/livestock/dairy/facts/09-003.htm>
4. Castration of bulls: <https://vikaspedia.in/agriculture/livestock/general-management-practices-of-livestock/castration-of-ruminants>
5. Deworming: https://kvk.icar.gov.in/API/Content/PPupload/k0347_10.pdf
6. Pasteurization of milk : <http://www.jnkvv.org/PDF/08042020170652part%203.pdf>
7. <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1690>
8. Cream separation: <http://ecoursesonline.iasri.res.in/mod/page/view.php?id=147910>

Web resources suggested by the teacher concerned and the college librarian including reading material

Co-Curricular Activities

a) **Mandatory:** (Lab/field training of students by teacher; lab 10+ field :05)

1. For Teacher: Training of students by the teacher in laboratory and field for not less than 15 hours on skills of dairy management – housing-management of dairy animals of various stages- procedure of preparation of marketable milk with procedures like sterilization, pasteurization and other techniques)
2. For Student: Student shall (individually) visit a nearby dairy farm- household cattle rearing – make observations on aspects like housing – management – feed- milk- revenue- breed selection- qualities of breed –etc. A handwritten Fieldwork/Project work Report to be submitted in the given format.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements.*
5. (IE) Unit tests.



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b) Suggested Co-Curricular Activities

1. Sketch model dairy house with details
2. Web resources on Protocols in the management of stages of cattle
3. Properties of varieties of milk from the market observation
4. Assignment, Seminar, Invited lecture, Group discussion. Quiz, Collection of Material, Video preparation etc.



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MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - V (Skill Enhancement Course - Elective)

Course - 7B: **Live Stock Management -II**

(Dairy Production And Management)

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

1. Water requirement of dairy animals
2. Drawing of layouts for dairy cattle dwellings
3. Heifers
4. Vaccination
5. Objections of Pasteurization
6. Principles of heat exchange
7. Cream and its composition
8. Types of cream separators

Section - B

Answer ALL the following:

5x10=50M

9. a. Explain the systems of housing in dairy cattle.
OR
b. Give an account of selection site for establishing dairy farm buildings.
10. a. Write an essay on management of milk producing and dry animals.
OR
b. Discuss the management practices of dairy farm.
11. a. Describe the methods of Pasteurization.
OR
b. Write an account of Homogenization and add a note on factors influencing homogenization.
12. a. Explain the standards and methods for manufacture of full cream milk.
OR
b. Give an account of market milk.
13. a. Describe the methods of cream separation
OR
b. Explain various factors affecting fat losses in skim milk and fat percentage in cream.



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B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:4
Paper: 6C	Poultry Management- I (Poultry Farming)	Hrs/Wk:4

Learning Outcomes:

Students at the successful completion of the course will be able to

- Evaluate the status of Indian Poultry Industry
- Explain the Scientific Poultry keeping
- Compare the diversified Poultry practices
- Inspect the different breeds of chicken

Syllabus: (Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

UNIT I: Indian poultry Industry

- 1.1 Importance of poultry farming and poultry development in India.
- 1.2 Present status and future prospectus of poultry Industry
- 1.3 Classification of poultry based on genetics Utility

UNIT II: Scientific Poultry Keeping

- 2.1 Modern breeds of Chicken
- 2.2 Present day egg production lines- meat production lines
- 2.3 Mini breeds- dwarfism in mini-Leghorns

UNIT III: Diversified Poultry

- 3.1 Ducks and Geese-classification- rearing system-classification-advantages
- 3.2 Guinea fowls - guinea fowl farming in India-Production-varieties
- 3.3 Emu-rearing- Economical aspects-commercial products

UNIT IV: Desi Chickens:

- 4.1 Indigenous breeds and economical aspects of desi chicken
- 4.2 Indigenous breeds-Aseel-Chittagong-Kadaknath-Bursa
- 4.3 Improved varieties in India – Giriraja-Vanaraja-Girirani-Kalinga brown, Gramapriya, Swarnandhra

UNIT V: Breeds from Central Avian Research Institute – Izatnagar

- 5.1 CARI Nirbheek - CARI- Shyama-HITCARI (Naked Neck Cross)
- 5.2 CARI- Priya Layer, CARI- Sonali Layer,
- 5.3 CARIBRO-VISHAL, CARI-RAINBRO,
- 5.4 Nandanam chicken-I, Nandanam Chicken-II, Nandanm-Quail

REFERENCES:

1. Text Book of Poultry Science, P V Sreenivasaiyah, Write and Print Publications, ISBN No. 9788192970592, 8192970590
2. Poultry Science Practices, Nilothpal Ghosh, CBS Publication & Distributions, 2015
3. Principles of Poultry Science, 1996, CAB Publishers, ISBN 9780851991221
4. A Text Book of Animal Husbandry, C. C. Banerjee, Oxford and IBH, Publish Co, ISBN: 9788120412606

WEB SOURCES

1. <https://www.drvet.in/p/e-books.html>
2. <https://byjus.com/biology/animal-husbandry-poultry-farming/>
3. https://www.helpforag.app/2018/02/livestock-production-and-management-lpm_14.html?m=1



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B. Sc	Semester: V (Skill Enhancement Course - Elective)	Credits:1
Paper: 6C	Poultry Management- I Lab (Poultry Farming)	Hrs/Wk:2

Learning Outcomes: On successful completion of this practical course, student shall be able to:

- Identify different types of Poultry rearing practices
- Evaluate the efficacy of different types of poultry practices in maximizing yield
- Understand the importance of different hybrid breeds in poultry

Practical (Laboratory) Syllabus :(30hrs) (Max.50Marks)

1. Different types of Poultry rearing (Students has to observe and draw the different types of poultry rearing systems)
2. Different types of poultry Housing - Models / Images/charts
3. Different layer breeds images/charts/ Models (Observation of characters)
4. Types of broilers images/charts/ Models (Identification of important Characters)
5. CARI breeds characters –images/charts
6. Nandanam breeds- images/charts (Identification of characters)

*** (This practical is 70 % (Web based /virtual) 30% physical: student and teachers must browse the web for the specimens models – write down the important characters based on the web resources)

Lab references

1. A Text Book of Animal Husbandry, C. C. Banerjee, Oxford and IBH, Publish Co, ISBN: 9788120412606

Web resources suggested by the teacher concerned and the college librarian including reading material

Co-Curricular Activities:

a) **Mandatory:**(*Student training by teacher in field skills: total 15 hours (lab: 10, field 05)*)

1. For Teacher: Training of students by the teacher in laboratory and field for not less than 15 hours on the techniques of identification of layers, broilers and management practices in poultry.
2. For Student: Students shall individually visit a Poultry farm, make observations and report on the Rearing, Housing, Brooding, Feeding and water management activities. The student shall submit a handwritten Fieldwork/Project work Report on the observations along with pictures in the given format not exceeding 10 pages to teacher.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, detail of place visited, observations made, findings and acknowledgements.*
5. Unit tests. (IE)

b) **Suggested Co-Curricular Activities**

1. **Web resources** –visiting the web sites of CARI-IZATNAGAR-
<https://cari.icar.gov.in> procuring additional information on the poultry breeds
2. Web resources- visiting the web site of NANADANAM
http://www.tanuvas.ac.in/ipmmadhavaram_tech.html
3. Collection of additional data on different types of Poultry breeds
4. Seminar, Assignment, Group discussion. Quiz, Collection of Material, Invited Lecture, Videopreparation etc.



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MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - V (Skill Enhancement Course - Elective)
Course - 6C: Poultry Management- I (Poultry Farming)

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

1. Classify the poultry based on genetics Utility (**Analysis level**)
2. Write a detail note on meat production lines (**Knowledge level**)
3. Explain about Present day egg production line (**Understand level**)
4. Describe in detail about rearing system of Ducks (**Understand level**)
5. Write a detail note on Nandanam chicken-I (**Knowledge level**)
6. Explain about Gramapriya, and Swarnandhra(**Understand level**)
7. Write an essay on poultry development in India. (**Knowledge level**)
8. Discuss about Shyama-HITCARI (Naked Neck Cross) (**Understand level**)

Section - B

Answer ALL the following:

5x10=50M

9. A. Write an essay on Present status and future prospectus of poultry Industry in India (**Knowledge level**)

OR

B. Write a detail note on Importance of poultry farming and poultry development in India. (**Remembering level**)

10. A. Explain about Modern breeds of Chicken (**Knowledge level**)

OR

B. Write an essay on Mini breeds of poultry farming(**Understand level**)

11. A. Discuss in detail about guinea fowl farming in India, and add a note on Production and varieties (**Understand level**)

OR

B. Discuss about Emu-rearing. Add a note on Economical aspects and commercial products of Emu. (**Understand level**)

12. A. What are Indigenous breeds? Explain about any two Indigenous breeds (**Knowledge level**)

OR

B. Write an essay on Improved varieties of poultry birds in India (**Application level**)

13. A. Distinguish about CARIBRO-VISHAL and CARI-RAINBRO (**Analysis level**)

OR

B. Discuss in detail about CARI- Priya Layer and CARI- Sonali Layer (**Knowledge level**)



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B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:4
Paper: 7C	Poultry Management -II (Poultry Production and Management)	Hrs/Wk:4

Learning Outcomes:

Students at the successful completion of the course will be able to

- Suggest measure for Health care in Poultry
- Evaluate the economics of poultry production
- Elaborate the poultry Breeder flock management
- Differentiate the poultry hatchery practices

Syllabus: (Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)

UNIT I: HEALTH CARE

- 1.1 Common poultry diseases: bacterial, viral, fungal, parasitic and nutritional deficiencies.
- 1.2 Vaccination schedule for commercial layers and broilers: factors that govern vaccination schedule; vaccination principles type, methods, pre and post vaccination care.
- 1.3 Disinfection: Types of disinfectants; mode of action; recommended procedure; precaution and handling.

UNIT II: ECONOMICS

- 2.1 Economics of layer and broiler production
- 2.2 Projects reports in different systems of rearing for layer & broilers.
- 2.3 Feasibility studies on poultry rearing- in context of small units and their profitability.
- 2.4 Export/import of poultry and poultry products.

UNIT III: BREEDER FLOCK MANAGEMENT

- 3.1 Layer and broiler breeder flock management housing & space requirements.
- 3.2 Different stage of management during life cycle; Light management during growing and laying period, Artificial insemination.
- 3.3 Feeding: Feed restriction, separate male feeding. Nutrient requirement of layer and broiler breeders of different age groups.

UNIT IV: BREEDER HEALTHCARE

- 4.1 Vaccination of breeder flock; difference between vaccination schedule of broilers and commercial birds.
- 4.2 Common diseases of breeders (Infectious and metabolic disorders)-prevention.
- 4.3 Fertility disorder- etiology, diagnosis and corrective measures. Selection and culling of breeder flocks

UNIT V: HATCHERY PRACTICES

- 5.1 Management principles of incubation.
- 5.2 Factors affecting fertility and hatchability. Selection, care and incubation of hatching eggs. Fumigation; sanitation and hatchery hygiene.
- 5.3 Importance of hatchery records, break even analysis of unhatched eggs.
- 5.4 Computer applications for hatchery management

REFERENCES:

1. HVS Chauhan, S. Roy, Poultry Diseases, Diagnosis and Treatment, New Age International Publishers-2018
2. <https://www.drvet.in/p/e-books.html>
3. <https://byjus.com/biology/animal-husbandry-poultry-farming/>
4. https://www.helpforag.app/2018/02/livestock-production-and-management-lpm_14.html?m=1



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B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:1
Paper: 7C	Poultry Management -II Lab (Poultry Production and Management)	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

- Identify Poultry diseases by observation
- Analyze Poultry establishment feasibility
- Understand the Poultry Records

Practical (Laboratory) Syllabus:(30hrs) (Max.50Marks)

1. Poultry Viral diseases – Observation of histopathological slides
2. Poultry Fungal Diseases- Observation of histopathological slides
3. Poultry Bacterial Diseases-Observation of histopathological slides
4. Feasibility study of Poultry establishment: (Preparation of feasibility study report with given parameters)
5. Rearing of Layers – (Preparation of Flow chart
6. Rearing of broiler- Flow chart
7. Hatchery records- Model study/analysis- Report with modified data

Lab references:

1. HVS Chauhan, S. Roy, Poultry Diseases, Diagnosis and Treatment, New Age International Publishers-2018
2. Flow chart hatchery : <http://lms.tanuv.ac.in/mod/resource/view.php?id=45106>
3. Feasibility report:
<https://www.manage.gov.in/stry&fcac/content/19.%20Project%20Report%20on%20Layer%20Poultry.pdf>

Web resources suggested by the teacher concerned and the college librarian including reading material

Co-Curricular Activities

a) Mandatory:(Lab/filed training of students by teacher: (lab10+ field 05)

1. For Teacher: Training of students by the teacher laboratory and field for not less than 15 hours on skills in different practices employed in poultry with regard to the disease management – analysis of poultry project- preparation of flow chart – Observation of Poultry records – computerization activities
2. For Student: students shall (individually) visit a Layer/ Broiler Poultry farming places (small scale/corporate), make observations on practices- resources – management and marketing - analysis and submit a handwritten Fieldwork/Project work Report of 10 pages with necessary images.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements.*
5. (IE): Unit tests.

b) Suggested Co-Curricular Activities

1. Preparation of Poultry diseases charts
2. Preparation of feasibility report poultry establishment with different variables
3. Seminar, Assignment, Group discussion. Quiz, Collection of Material, Invited Lecture, Video preparation etc.



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B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - V (Skill Enhancement Course - Elective)

Course - 7C: Poultry Management -II

(Poultry Production and Management)

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

14. Fungal diseases in poultry
15. Broilers
16. Artificial insemination
17. Metabolic disorders
18. Fumigation
19. Sanitation and hatchery hygiene
20. Vaccination for commercial birds.
21. Feed restriction

Section - B

Answer ALL the following:

5x10=50M

22. A. Discuss in detail about any two viral and bacterial diseases in poultry

OR

B. Define Disinfection. Add a note on Types of disinfectants, and their mode of action

23. A. Write an essay on Economics of layer and broiler production

OR

B. Explain about Export and import of poultry and poultry products.

24. A. Discuss in detail about Nutrient requirement of layer and broiler breeders of different age groups.

OR

B. Write an essay on Layer and broiler breeder flock management housing & space requirements

25. A. Write a detail note on Fertility disorder- etiology, diagnosis and corrective measures

OR

B. Write an essay on Common Infectious diseases of breeders and their prevention.

26. A. Explain about hatchery Management principles of incubation.

OR

B. Write a detail note on Computer applications for hatchery management

**ADIKAVI NANNAYA UNIVERSITY:: RAJAHMAHENDRAVARAM****B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)**

B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:4
Paper: 6D	Seri Culture -I***	Hrs/Wk:4

Learning Outcomes:

Students at the successful completion of this course will be able to

- Evaluate the general status of Sericulture in India
- Understand the development of sericulture Botany
- Evaluate the use of Silk worm breeds
- Differentiate among various silkworm breeds
- Apprise the economics of silk rearing

Syllabus: (Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)**UNIT I:** A general introduction to Sericulture

- 1.1 Sericulture map of India: Components of Sericulture.
- 1.2 Textile fibers: Types- natural and synthetic fibers- types of silk produced in India; Importance of mulberry silk:
- 1.3 Sericulture organization in India; role of state departments of Sericulture, Central Silk Board and NGOs in Sericulture development

UNIT II: Sericultural Botany.

- 2.1 Taxonomy of mulberry and food plants of silkworms: Study of salient features of the families Marceau.
- 2.2 Morphology of mulberry: different varieties of mulberry.
- 2.3 Anatomy of mulberry: internal structure of stem, root and leaf; secondary growth in root and stem.

UNIT III: Floral biology of mulberry

- 3.1 Floral biology of mulberry: Sexual behavior, different types of anthers and ovule in mulberry; micro- and megaspore genesis.
- 3.2 Development of male and female gametophytes; pollination, fertilization
- 3.3 Development of endosperm, embryo and seed; polyembryony and parthenocarpy in mulberry.

UNIT IV: Silkworm Biology.

- 4.1 Characteristic features of the order Lepidoptera; detailed study of the families- Saturniidae and Bombycid. Classification of sericigenous insects.
- 4.2 Classification of silkworms based on moultnism, voltinism and geographical distribution; popular silkworm breeds and hybrids of Karnataka; their economic traits

UNIT V: Morphology and anatomy of reproductive systems of silk moth.

- 5.1 Life cycle of Bombyx Mori; morphology of egg, larva, pupa and adult.

***** This course shall be completely taught by Zoology faculty**

REFERENCES:

1. Hortmann and Kesler (1993) Plant Propagation, principles and practices. Prentice Hall, Hemel Nemstead.
2. Krishna Murthy, N.(1981) Plant growth substances including application in Agriculture. Tata McGraw Hill Pub. Co. Ltd. New Delhi.
3. Shankar, M.A (1998) Handbook on mulberry Nutrition, Multiplex, Bangalore.
4. Subbarao, N.S (1998) Bio fertilizers in Agriculture. Oxford & IBH Pub. Co, Pvt. Ltd, New Delhi.
5. A text Book on Mulberry Crop Protection. Govindaiah, V.P Gupta, D.D Sharma, S. Rajadurai and V. Nishitha Naik, Published by Central Silk Board, Bangalore-68, India.2005.
6. Rajanna L, Das P.K, Ravindra S, Bhogeshha K , Mishra R.K, Singhvi N.R, Katigar R.S and Jayaram H. Mulberry Cultivation and Physiology Central Silk Board, Bangalore, Dec.2005



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Web resources:

1. <http://www.fao.org/3/ad108e/ad108e0a.htm>
2. https://onlinecourses.swayam2.ac.in/cec19_bt05/preview
3. <https://www.skuastkashmir.ac.in/DisplaySInformation.aspx?id=16&pid=20592>
4. <http://www.fao.org/3/x9895E/x9895e04.htm>
5. <https://www.notesonzoology.com/sericulture/moriculture/common-indian-mulberry-plants-and-their-morphological-characteristics/347>

Web resources suggested by the teacher concerned and the college librarian including reading material



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B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:1
Paper: 6D	Seri Culture -I*** Lab	Hrs/Wk:2

Learning Outcomes:

On successful completion of this practical course, student shall be able to:

- Develop sericulture map of India
- Develop charts on production of silk
- Examine the popular varieties of mulberry
- Display the silk glands of silk worm

Practical (Laboratory) Syllabus:(30hrs)

(Max.50Marks)

1. Sericulture map of India and Karnataka.
2. Preparation of histograms and pie charts on:
3. Production of textile fibers in India.
4. Pie chart on mulberry and non-mulberry silk production in India.
5. Life cycle of *Bombyx mori*- Morphology of egg, larva, pupa and adult of *Bombyx mori*.
6. Sex separation in larva, pupa and adult of the silkworm *Bombyx mori*.
7. Dissection and display of: Digestive system of larva. Silk glands.

Lab References :

1. Rajanna L, Das P.K, Ravindra S, Bhogesh K , Mishra R.K, Singhvi N.R, Katigar R.S and Jayaram H. Mulberry Cultivation and Physiology Central Silk Board, Bangalore, Dec.2005

Web sources suggested by the teacher concerned and the college librarian including reading material

Co-Curricular Activities :

a) **Mandatory:** (*Student training by teacher in field skills: total 15hrs, Lab: 10+ filed 05*):

1. For Teacher: Training of students by the teacher in the laboratory and field for not less than 15 hours on the skills of preparation of Sericulture Map of India – identification of Mulberry plants – plantation- observation of Silk worm reproductive biology- observation of silk glands
2. **For Student:** Students shall (individually) visit any local Mulberry Plantation area and Silk worm Rearing center – make observations on plants, procedures and yield. Observations and outcomes shall be submitted as Fieldwork/Project work Report not exceeding 10 pages to teacher in the given format.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements.*
5. (IE) Unit tests.

b) Suggested Co-Curricular Activities

1. Webbased : Collection of additional information of mulberry plants
2. Charts /Models preparation of silkworm developmental stages
3. Seminar, Invited lecture, .
4. Assignment, Group discussion. Quiz, Collection of Material, Videopreparation etc.



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B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - V (Skill Enhancement Course - Elective)

Course - 6D: Seri Culture -I***

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

1. Importance of mulberry silk:
2. Central Silk Board
3. Anatomy of mulberry leaf
4. Microsporogenesis
5. Classification of sericigenous insects
6. Larva of Bombyx
7. Types of silks
8. order Lepidoptera

Section - B

Answer ALL the following:

5x10=50M

9. A. Write an essay on Components of Sericulture.

OR

B. Write a detail note on natural and synthetic fibers

10. A. Explain the salient features of the families Marceau

OR

B. Write an essay on different varieties of mulberry.

11. A. Enumerate about different types of anthers and ovule in mulberry

OR

B. Write an essays on pollination, fertilization in mulberry

12. A. Write a detail note on family Saturnidae and Bombycid

OR

B. Classify the silkworms based on moultnism, voltinism and geographical Distribution

13. A. Write an essay on Life cycle of Bombyx Mori

OR

B. Write an essay on Morphology and anatomy of reproductive systems of silk moth

**ADIKAVI NANNAYA UNIVERSITY:: RAJAHMAHENDRAVARAM****B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)**

B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:4
Paper: 7D	Sericulture -II	Hrs/Wk:4

Learning Outcomes:

Students at the successful completion of this course will be able to

- Design low cost rearing house preparation for silk worm rearing
- Formulate procedure of sanitation of rearing house
- Make use of Chawki rearing practice
- Decide and suggest the correct time for harvest
- Develop and Maintain the records related to sericulture

Syllabus: (Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)**UNIT I:**

- 1.1 Rearing house: Location, orientation, plan and utilities; model rearing house; low-cost rearing house.
- 1.2 Rearing appliances-shelf and shoot rearing; requirements of rearing appliances (per unit rearing of 100dfis).

UNIT II:

- 2.1 Disinfection of rearing house and rearing appliances; (disinfectants formalin, bleaching powder, chlorine dioxide, slaked lime and iodine compounds);
- 2.2 Rearing and personal hygiene.

UNIT III:

- 3.1 Incubation- definition, requirement of environmental conditions, incubation devices; identification of stages of development; black boxing and its importance.
- 3.2 Chawki rearing: Preparation; brushing and its methods; types of chawki rearing - traditional and improved method; optimum environmental conditions; methods and frequency of feeding; methods of bed cleaning; spacing; moulting and care during moult.

UNIT IV:

- 4.1 Late age silkworm rearing: Methods; optimum environmental conditions; feeding quantity and frequency; methods of bed cleaning; spacing; moulting and care during moult.
- 4.2. Identification of spinning larva; spinning; mounting and mounting density; types of mountages, their advantages and disadvantages; environmental requirements during spinning.

UNIT V:

- 5.1 Harvesting: Time of harvesting; sorting, storage/ preservation
- 5.2 Packaging and transport of cocoons; leaf-cocoon ratio; Maintenance of rearing records.

REFERENCES:

1. Charley, S.R. (1982). Culture and Sericulture. Academic Press Inc., New York, U.S.A
2. Chowdhury, S.N. (1998) Muga Culture. Central Silk Board, Bangalore, India
3. Dokuhon, Z.S. (1998). Illustrated Textbook on Sericulture. Oxford & IBH publishing Co., Pvt. Ltd.Calcutta.
4. Hamamura, Y. (2001). Silkworm rearing on Artificial Diet. Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.
5. Hasao Aruga (1994). Principles of Sericulture (Translated from Japanese) Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.



ADIKAVI NANNAYA UNIVERSITY:: RAJAHMAHENDRAVARAM
B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

Web Resources:

1. <http://www.fao.org/3/ad108e/ad108e0a.htm>
2. https://onlinecourses.swayam2.ac.in/cec19_bt05/preview
3. <https://www.skuastkashmir.ac.in/DisplaySInformation.aspx?id=16&pid=20592>



ADIKAVI NANNAYA UNIVERSITY:: RAJAHMAHENDRAVARAM
B.Sc Zoology Syllabus (w.e.f: 2020-21 A.Y)

B. Sc	Semester: V(Skill Enhancement Course - Elective)	Credits:1
Paper: 7D	Sericulture -II Lab	Hrs/Wk:2

Learning Outcomes:

- On successful completion of this practical course, student shall be able to :
- Appreciate the morphology of silkworm
- Realize the importance of and initiate measures to disinfect the importance of disinfection of rearing houses and rearing appliances
- Differentiate the methods of incubation of silkworm eggs
- Prioritize the records in silkworm rearing

Practical (Laboratory) Syllabus :(30hrs)(Max.50Marks)

1. Morphology and structure of silkworm egg, fertilization, Diapause development
2. Rearing house: Location, orientation, plan and utilities; model rearing house; low-cost rearing house.
3. Disinfection of rearing house and rearing appliances;
4. Incubation of silkworm eggs- Methods; black boxing; maintenance of temperature and humidity; Brushing: Methods; chawki rearing; use of paraffin paper and blue polythene sheet.
5. Bed cleaning: use of bed cleaning net and disposal of bed refuses and silkworm litter.
6. Moulting: Identification of moulting larva, care during moulting; mounting and mounting density; harvesting of cocoons; assessment of cocoons; types of mountages;
7. Study the mulberry leaf by graph paper method : (for calculating the leaf area)

Lab References

1. Hasao Aruga (1994). Principles of Sericulture (Translated from Japanese) Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.

Web resources suggested by the teacher concerned and the college librarian including reading material

Co-Curricular Activities

a) Mandatory: (Lab/field training of students by teacher (lab10+filed5)

1. For Teacher: Training of students by the teacher in laboratory and field for not less than 15 hours on the skills/techniques of Rearing of Silk moth
2. For Student: Students shall (individually) visit to Silk worm rearing center and observe all the procedures. He/she shall prepare a Fieldwork/Project work Report on the observations made in the given format not exceeding 10 pages and submit to teacher.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work Report: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements.*
5. (IE). Unit tests.

b) Suggested Co-Curricular Activities

1. Model Chart preparation of chawki rearing
2. Cocoon collection and observation of characteristics
3. Mountage images / charts preparation
4. Seminar, Invited Lecture, Assignment, Seminar, Group discussion. Quiz, Seminar, Quiz, Collection of Material, Video preparation etc.



MODEL QUESTION PAPERS(Semester - End)

B .Sc DEGREE EXAMINATIONS

SEMESTER - V (Skill Enhancement Course - Elective)
Course - 7D: Seri Culture -II

Time: 3hrs.

Max. Marks: 75

Section - A

Answer any FIVE of the following:

5x5=25M

1. Low-cost rearing house.
2. Slaked lime
3. Black boxing and its importance
4. Spacing
5. Environmental requirements during spinning
6. Methods of bed cleaning
7. Sorting
8. Leaf-cocoon ratio

Section - B

Answer ALL the following:

5x10=50M

9. A. Write an essay on construction of model rearing house for sericulture

OR

B. Discuss in detail about requirements of rearing appliances

10. A. Write an essay on Rearing and personal hygiene.

OR

B. Write a detail note on disinfection of rearing house and rearing appliance

11. A. Define Incubation. Write a note on requirement of environmental conditions and incubation devices;

OR

B. What is Chawki rearing? Discuss about traditional and improved method of chawki rearings

12. A. Write an essay on Methods of Late age silkworm rearing.

OR

B. Write a detail note on spinning; mounting and mounting density.

13. A. Write an essay on Maintenance of rearing records.

OR

B. Discuss in detail about storage and preservation of silk months