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S.V.K.P. & Dr. K.S. RAJU ARTS & SCIENCE COLLEGE
(Autonomous)
Recognized by UGC as "College with Potential for Excellence"
Accredited by NAAC with "A" Grade
(Affiliated to ADIKAVI NANNAYA UNIVERSITY - Recognised by Govt. of Andhra Pradesh)
PENUGONDA-534 320, West Godavari District., (A.P.)

I Semester Syllabus (w.e.f. 2020-21 Admitted Batch)

ZOOLOGY

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

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 (typestudy)*

UNIT II:

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

Phylum Coelenterate: General characters and classification up to classes 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 classes level with suitable examples. Life cycle and pathogen city of *Fasciolahepatica,* Parasitic Adaptations in helminthes.

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

UNIT IV:

Phylum Annelida: General characters and classification up to classes level with suitable examples, Evolution of Coelom and Coelomoducts, Vermiculture - Scope, significance, earthworm species, processing, Vermicompost- economic importance of vermicompost.

Phylum Arthropoda : General characters and classification up to classes level with suitable examples. 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 classes level with suitable examples, Pearl formation in Pelecypoda, Sense organs in Mollusca,

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

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

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. Dhami and J.K. Dhami. 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

Syllabus:

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

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

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

Coelenterata: *Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium, Gorgonia, Pennatula*v.

Platyhelminthes: *Planaria, Fasciola hepatica, Fasciola*larval forms – Miracidium, Redia, Cercaria, *Echinococcusgranulosus, Taeniasolium, Schistosomahaematobium*vii.

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 practical Examination

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**

RFERENCE 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

UNIT I:

General characters and classification of Chordata upto classes level, Protochordata-Salient features 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: ***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

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 PressLtd., UK). 852 pages. (Revised edition of Parker &Haswell,1961).
4. M. Ekambaranatha Ayyar, 1973. A manual of zoology. Part II. (S. ViswanathanPvt. Ltd.,Madras).
5. P.S. Dhami& J.K. Dhami, 1981. Chordate zoology. (R. Chand & Co.). 550pages.
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).632pages.
9. E.L. Jordan & P.S. Verma, 1998. Chordate zoology. (S. Chand & Co.). 1092pages.
10. G.S. Sandhu, 2005. Objective Chordate Zoology. Campus Books, vii, 169pp.
11. Sandhu, G.S. & H. Bhaskar, H. 2004. Textbook of Chordate Zoology.

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

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

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

SYLLABUS

UNIT I:

Cell Biology: Definition, history, prokaryotic and eukaryotic cells, 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

UNIT II:

Genetics-I: Mendel's work on transmission of traits Gene Interaction – Incomplete Dominance, Codominance, Lethal Genes; Multiple Alleles (General Characteristics and Blood group inheritance) Sex determination , Sex linked inheritance (X-linked, Y-linked & XY-linked inheritance)

UNIT III:

Genetics - II: Mutations, Chromosomal Disorders (Autosomal and Allosomal) Human Genetics – Karyo typing, Pedigree Analysis(basics)

UNIT IV:

Molecular Biology: Central Dogma of Molecular BiologyBasic 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-transcriptionalmodifications(basics)
3. Translation – Initiation, Elongation and Termination, Gene Expression in prokaryotes (LacOperon);

UNIT V:

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

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

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 *Chiranomous*

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'ssyndrome 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, UttarPradesh,India.
7. Rastogi VB. 1991. *Organic Evolution.*KedarNath Ram Nath Publications,Meerut,UttarPradesh,India.
8. Stahl FW. 1965. *Mechanics of Inheritance.* Prentice-Hall.
9. White MJD. 1973. *Animal Cytology and Evolution.* Cambridge Univ.Press.

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

SYLLABUS

UNIT I:

Animal Physiology -I: Process of **digestion** and assimilation, **Respiration** - Pulmonary ventilation, transport of oxygen and CO_2, (Note: Need not study cellular respiration here), **Circulation** - Structure and functioning of heart, Cardiac cycle, **Excretion** - Structure and functions of kidney urine formation.

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 .

UNIT IV:

Cellular Metabolism –II: Carbohydrate Metabolism - Glycolysis, Krebs cycle, Gluconeogenesis, **Lipid Metabolism** – Synthesis of fatty acids, **Protein metabolism** - Transamination, Deamination and Urea Cycle

UNIT V:

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

REFERENCE BOOKS:

1. Eckert H. *Animal Physiology: Mechanisms and Adaptation.* W.H. Freeman &Company.
2. Floray 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, NewDelhi.
5. Lehninger AL. Nelson and Cox. *Principles of Biochemistry.* Lange MedicalPublications, NewDelhi.
6. Prosser CL and Brown FA. *Comparative Animal Physiology.* W.B. SaundersCompany,Philadelphia.
7. Developmental Biology byBalinksy
8. Developmental Biology by GerardKarp
9. Chordate embryology by Varma andAgarwal
10. Embryology by V.B.Rastogi
11. Austen CR and Short RV. 1980. *Reproduction in Mammals*. Cambridge UniversityPress.
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.* KedaraNath Ram Nath Publishers, Meerut, UttarPradesh.
15. Schatten H and Schatten G. 1989. *Molecular Biology of Fertilization.* AcademicPress, NewYork.

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

PRACTICAL SYLLABUS

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

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

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)

UNIT IV:

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

Gene delivery: Microinjection, electroportion, 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, *Invitro* 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

REFERENCE BOOKS:

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

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

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

UNIT I:

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

UNIT II:

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

UNIT III:

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

UNIT IV:

Macrobrachium rosenbergii- biology, seed production.
Culture of L. vannamei – hatchery technology and culture practices
Mixed culture of fish and prawns

UNIT V:

Viral diseases of Fin Fish & shell fish
Fungal diseases of Fin & Shell fish
Bacterial diseases of Finfish & Shell fish

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. Elsivier Scientific Publishing Company.
4. Bose AN et.al. 1991. Costal Aquaculture Engineering. Oxford & IBH Publishing Company Pvt. Ltd.

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B. Sc	**Semester: V**(Skill Enhancement Course - Elective)	**Credits:1**
Paper: 5A1	**Sustainable Aquaculture Management Lab**	**Hrs/Wk:2**

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

- Identify the characaters of Fresh water cultivable species
- Estimate physico chemical characateristics 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 histo 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/x67 08e06.htm
3. http://aquaticcommons.org/1666/1/Better-Practice3_opt.pdf

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S.V.K.P. & Dr. K.S. RAJU ARTS & SCIENCE COLLEGE
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(Affiliated to ADIKAVI NANNAYA UNIVERSITY - Recognised by Govt. of Andhra Pradesh)
PENUGONDA-534 320, West Godavari District., (A.P.)

SEMESTER V

III B.Sc ZOOLOGY (20ZOO5A2)

PAPER- 5A2 (POSTHARVEST TECHNOLOGY- FISH AND FISHERIES)

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 lowradiation 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 isinglass, 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*.

PAPER- 5A2 P(POSTHARVEST TECHNOLOGY- FISH AND FISHERIES LAB)

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

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

Practical (Laboratory) Syllabus:

1. Evaluation of fish/ fishery products for organo leptic, chemical and microbial quality.
2. Preparation of dried, cured and fermented fish productsFor 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 hazardanalysis 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-Leaarningdownload3_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%2 0for%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
7. %20drying%20and%20packing%20of%20fish.pdf
8. https://krishi.icar.gov.in/jspui/bitstream/123456789/20770/1/Training%20Manual_Hygienic
9. %20drying%20and%20packing%20of%20fish.pdf
10. https://agritech.tnau.ac.in/fishery/fish_byproducts.html
11. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5352841/
12. http://www.fao.org/3/i1136e/i1136e.pdf
13. http://www.fao.org/3/x5989e/X5989e01.htm#What%20is%20sensory%20assessment)