Rayat Shikshan Sanstha's

SADGURU GADAGE MAHARAJ COLLEGE, KARAD.

(An Autonomous)

Accredited By NAAC with 'A^{+} (3.63 CGPA)' Grade

ISO- 9001-2015 Certified

Affiliated to Shivaji University, Kolhapur

Bachelor of Science (B.Sc.)

DEPARTMENT OF ZOOLOGY (ENTIRE)

Under the Faculty of Science and Technology
Choice Based Credit System (CBCS)

Regulations in accordance with **National Education Policy-2020**
to be implemented from Academic Year 2023-24

Syllabus For

B.Sc. Part –I (ZOOLOGY-Entire)

SEMESTER I & II

(Syllabus to be implemented from June 2023)

Rayat Shikshan Sanstha's
SADGURU GADAGE MAHARAJ COLLEGE, KARAD.
(An Autonomous College)
Regulations and Guidelines as per NEP 2020

Choice Based Credit System (CBCS) Syllabus for Bachelor of Science Part- I (Zoology - Entire)

1. Title: B.Sc. I Zoology (Entire)

2. Year of Implementation: 2023-24

3. Preamble:

1) To impart the knowledge of animal science to the pupils.
2) To make the pupils to use the knowledge in their daily life.
3) To make the pupils aware of natural resources and environment.
4) Application of knowledge in Zoology for nutrition, agriculture & livestock.
5) To provide practical experiences which form a part of their learning processes.
6) To develop aptitude for scientific work & ability to pursue studies far beyond graduation.
7) To encourage the pupils to take life science as a carrier which is the need now a day.
8) To make the pupils fit for the society.
9) In Autonomous the addition of more syllabus will be very helpful to students which will improve their knowledge in depth.
10) To inculcate in the student's highest values of life, understand the human niche in nature and apply the knowledge of life sciences for betterment of society.
11) To inspire students to reach frontiers of life sciences through commitment, hard work, study and research.

4. General Objectives of the Program:

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

5. Program Outcomes:

1. The student will graduate with proficiency in the subject of his choice.
2. The student will be eligible to continue higher studies in his subject.
3. The student will be eligible to pursue higher studies abroad.
4. The student will be eligible to appear for the examinations for jobs in government organizations.
5. The student will be eligible to appear for jobs with minimum requirement of B. Sc. Program.

6. Program Specific Objectives:

1. The students are expected to understand the fundamentals, principles, concepts and recent developments in the Zoology.
2. The practical course is framed in relevance with the theory courses to improve the understanding of the various concepts in Zoology.
3. It is expected to inspire and boost interest of the students in Zoology.
4. To develop the power of appreciations, the achievements in science and role in nature and society.
5. To enhance student sense of enthusiasm for science and to involve them in an intellectually stimulating experience of Course in a supportive environment.

Structure of the Course: B.Sc. I (Entire Zoology)

Level	Year	Sem.	Course Type	Course Code	Course Title	Credits	No. of Lectures / Practicals
4.5	I	Sem. I	Major	MJ-BZT23-101	Animal Diversity-I	2T	30
			Major	MJ-BZT23-102	Cell Biology and Genetics	2T	30
			Major	MJ-BZP23-103	Practicals Based on Animal Diversity-I and Cell Biology and Genetics	2P	15
			Minor	MN-BZT23-101	Animal Diversity-I	2T	30
			Minor	MN-BZT23-102	Cell Biology and Genetics	2T	30
			Minor	MN-BZP23-103	Practicals Based on Animal Diversity-I and Cell Biology and Genetics	2P	15
			OE /GE	GE-BZT23-101	Public Health and Hygiene	2T	30
			OE /GE	GE-BZT23-102	Medical and Forensic Zoology	2T	30
			OE /GE	GE-BZP23-103	Practicals Based on Public Health and Hygiene And Medical and Forensic Zoology	2P	15
			AEC	AECZ23-I	English - I	2T	30
			IKS	IKSZ23-101	Health and Well Being in Indian Knowledge System	2T	30

		Sem-II	Major	MJ-BZT23-201	Animal Diversity-II	2T	30
			Major	MJ-BZT23-202	Animal Physiology	2T	30
			Major	MJ-BZP23-203	Practicals Based on Animal Diversity-I I And Animal Physiology	2P	15
			Minor	MN-BZT23-201	Animal Diversity-II	2T	30
			Minor	MN-BZT23-202	Animal Physiology	2T	30
			Minor	MN-BZP23-203	Practicals Based on Animal Diversity-II And Animal Physiology	2P	15
			OE /GE	GE-BZT23-201	Food Nutrition and Dietetics	2T	30
			OE /GE	GE-BZT23-202	Freshwater Aquaculture	2T	30
			OE /GE	GE-BZP23-203	Practicals Based on Food Nutrition and Dietetics and Freshwater Aquaculture	2P	15
			AEC	AECZ23-II	English-II	2T	30
			SEC	SECZ23-201	Vermitechniques and Vermicomposting	2T	30

B.Sc. Zoology Semester I

Course Code and title: MJ-BZT23-101ANIMAL DIVERSITY – I (Major)

Credits: 02 **Total Lectures: 30**

COURSE OBJECTIVES

1. To learn the animal classification.
2. To understand the canal system in Sycon.
3. To acquire the knowledge about types of corals and parasitic adaptations of Tapeworm and Ascaris.
4. To identify the species of earthworm used for vermicomposting and vermiwash.

Topic No.		**Lectures**
	Credit – I	
1.	**Kingdom –Protista:** General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa. **Phylum-Porifera:** General characters and classification up to classes; Canal system in *Sycon*	7
2.	**Phylum –Cnidaria:** General characters and classification up to classes; Polymorphism in Hydrozoa. **Phylum-Platyhelminthes:** General characters and classification up to classes; Life history of *Taenia solium* and its parasitic adaptations.	8
	Credit –II	
3.	**Phylum-Nemathelminthes:** General characters and classification upto classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations. **Phylum –Annelida:** General characters and classification up to classes; Species of earthworm used for Vermicomposting, Preparation of Vermicompost bed and vermiwash.	7
4.	**Phylum –Arthropoda:** General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects **Phylum–Mollusca :** General characters and classification up to classes; Torsion in Gastropods **Phylum–Echinodermata :** General characters and classification up to classes; Water vascular system of Asteroidea	8

Course Outcomes: Student should be able to….

1. The animal classification.
2. Explain the canal system in Sycon.
3. Apply the knowledge about types of corals and parasitic adaptations of Tapeworm and Ascaris.
4. Classify the species of earthworm used for vermicomposting and vermiwash.

Reference Books:

1. Edward Ruppert and Robert Barnes, *Invertebrate Zoology*, VIII Edition. (Thomson Press: India, 2006) Pages 998.
2. Robert Barnes, Peter Calow, Olive, P.J.W. , Golding ,D. W. and Spicer , J.I. *The Invertebrates*: A New Synthesis, III Edition, (Oxfard, Wiley Blackwell Science, 2002) Pages: 512.
3. Brian Hall and Bendedikt Hallgrimsson (2008). Strickberger'sEvolution.IV Edition, (Jones and Barlett publishers Inc., 2008) Pages 760.
4. R.L. Kotpal. Modern Text Book of Zoology:Invertebrate 10thEdition. (Rastogi Publications, New Delhi, 2003).
5. Dhami. Invertebrate Zoology 10thEdition.(New Delhi, R. Chand & Company, 2003)
6. E.L. Jordan. Invertebrate Zoology 12thEdition. (S Chand & Co Ltd, India, 2013) Pages 848.

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B.Sc. Zoology Semester I

Course Code and title: MJ-BZT23-102 Cell Biology and Genetics(Major)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. To learn the cells and cell organelles.
2. To explain various cell organelles.
3. To sketch and label figures of cell organelles.
4. To learn about Genetics.
5. To explain various terms of Genetics.
6. To sketch and label various figures related to Genetics.

Topic No.		Lectures
	Credit – I	
1.	**Structure and Function of Cell -**Cell theory and diversity in cell size and shape **Structure and Function of Nucleus-** Nuclear membrane, Chromatin and Nucleolus. **Structure of and Function Chromosome-**Nucleosome concept and Polytene Chromosome.	10
2.	**Ultra Structure and Functions of** Plasma membrane (Fluid Mosaic Model), Mitochondria, Endoplasmic Reticulum, Golgi complex and Lysosomes**.**	5
	Credit –II	
3.	**Introduction to Genetics -** Mendel's work on transmission of traits, Genetic variation and Molecularbasis of Genetic variation. **Mendelian and Neo Mendelian Genetics** - Principles of Inheritance, Incomplete dominance and Co-dominance,Gene Interaction, Multiple Alleles (ABO blood groups, Rh factors and Coat colour in Rabbit) and Sex linked inheritance.	10
4.	**Mutations-** Chromosomal Mutations: Structural and Numerical changes, Euploidy and Aneuploidy, Induced Gene Mutation. **Genetic Counseling**	5

Course Outcomes: Student should be able to……

1. Define cells and cell organelles.
2. Explain various cell organelles.
3. Sketch and label figures of cell organelles.
4. Learn about Genetics.
5. Explain various terms of Genetics.
6. Sketch and label various figures related to Genetics

Reference Books:

1. De Robertis EDP and De Robertis EME – Cell and Molecular Biology
2. C.B. Powar – Cell biology , Himalaya Pub.House
3. Cell biology –Dr. N .Arumugam
4. Genetics by P.P.Meyyam
5. P.S.Verma &V.K.Agarwal-Cell biology , genetics , molecular biology, Evolution and Ecology
6. P.K. Gupta – Cell and Molecular Biology
7. VermaP.S. and Agarwal V .K. – Genetics , S. Chand and company
8. Strickberger – Genetics. C Millian publications
9. Winchester –Genetics Oxford publication
10. R.P. Meyyan , N , Arumugam – Genetics &Evolution
11. Gardner , E.J., Simmons , M.J., Snustad , D.P.(2008), Principles of Genetics ,VIII Edition ,WileyIndia.
12. Snustad , D.P. Simmons, M.J. (2009), 'Principles of Genetics', V Edition , JohnWiley and SonsInc.
13. Klug , W .S ., Cummings , M.R. Spencer ,C.A.(2012),Concepts of Genetics. X Edition, Benjamin Cummings.
14. Russell , P.J.(2009), Genetics A Molecular Approach III Edition.Benjamin cummings.
15. 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

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B.Sc. Zoology Semester I

Course Code and title: MJ-BZP23-103(Practical) Practicals Based on

Animal Diversity-I & Cell Biology and Genetics (Major)

Credits: 02 **Total Practicals: 15**

Sr. No.	Name of the Experiment	Number of practical
1.	**Study of the following Phyla with respect to classification and morphological peculiarities.-i.Protista:** *Amoeba, Euglena, Plasmodium, Paramoecium* **ii. Porifera:** Sycon, *Hyalonema* and *Euplectella*, Bath sponge **iii. Coelenterata:** Obelia, *Physalia, Aurelia, Tubipora*and *Metridium* **iv.Platyhelminthes:** *Taenia solium.*. **v. Nemathelminths:** *Ascaris lumbricoides,* **vi. Annelida:** *Aphrodite, Nereis, Pheretima, Hirudinaria* **vii. Arthropoda:** *Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis* **viii. Mollusca:** *Chiton, Dentalium ,Pila ,Unio, Loligo, Sepia,, Octopus* **ix. Echinodermata:** *Pentaceros ,Ophiura, Echinus, Cucumaria and Antedon*,	01
2.	**Study of the following:** i.T.S. and L.S. of Sycon. ii. Life cycle and parasitic adaptations of *Taenia* and *Ascaris*.	01
3.	Culture of Protozoa (Paramoecium culture)	01
4.	Preparation of portable vermicompost unit and economic importance of vermicompost.	01
5.	Preparations of Haemin and Hemochromogen crystals.	01
6.	Cytological Preparations of Mitochondria –Stained preparation of mitochondria from Oral mucosa by using Janus Green B.	01
7.	Cytological Preparations of Polytene Chromosome – Stained preparation of Polytene chromosome of Chironomus larva / Drosophila larva.	01
8.	Separation of nucleus from sheep liver by differential centrifugation method.	01
9.	Study of life cycle of Drosophila.	01
10.	Study of phenotypic variation in Drosophila (Wing and eye mutant)	01

11.	Human Genetics – Widows peak, Tongue roller, Ear lobes and Hypertrichosis.	01
12.	Study of Mendelian Inheritance: Monohybrid ratio, Dihybrid ratio, Incomplete dominance, Codominance and Multiple alleles.	01
13.	Study of Human Karyotypes.	01
14.	Study of Human Genetic traits.	01
15.	Study of Human Genetic traits.	01

B.Sc. Zoology Semester I

Course Code and title: MN-BZT23-101ANIMAL DIVERSITY – I (Minor)

Credits: 02 **Total Lectures: 30**

1. **Course Objectives:**
2. To learn the animal classification.
3. To understand the canal system in Sycon.
4. To acquire the knowledge about types of corals and parasitic adaptations of Tapeworm and *Ascaris*.
5. To identify the species of earthworm used for vermicomposting and Vermiwash

Topic No.		**Lectures**
	Credit – I	
1.	**Kingdom –Protista:** General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa. **Phylum-Porifera:** General characters and classification up to classes; Canal system in *Sycon*	7
2.	**Phylum –Cnidaria:** General characters and classification up to classes; Polymorphism in Hydrozoa. **Phylum-Platyhelminthes:** General characters and classification up to classes; Life history of *Taenia solium* and its parasitic adaptations.	8
	Credit –II	
3.	**Phylum-Nemathelminthes:** General characters and classification upto classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations. **Phylum –Annelida:** General characters and classification up to classes; Species of earthworm used for Vermicomposting, Preparation of Vermicompost bed and Vermiwash.	7
4.	**Phylum –Arthropoda:** General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects **Phylum–Mollusca :** General characters and classification up to classes; Torsion in Gastropods **Phylum–Echinodermata :** General characters and classification up to classes; Water vascular system of Asteroidea	8

Course Outcomes: Student should be able to….

5. The animal classification.
6. Explain the canal system in Sycon.
7. Apply the knowledge about types of corals and parasitic adaptations of Tapeworm and Ascaris.
8. Classify the species of earthworm used for vermicomposting and Vermiwash.

Reference Books:

7. Edward Ruppert and Robert Barnes, *Invertebrate Zoology*,VIII Edition. (Thomson Press: India, 2006) Pages 998.
8. RobertBarnes, Peter Calow, Olive, P.J.W. , Golding ,D. W. and Spicer , J.I. *The Invertebrates*: A New Synthesis, III Edition, (Oxfard, Wiley Blackwell Science, 2002) Pages:512.
9. Brian Hall and Bendedikt Hallgrimsson (2008). Strickberger's Evolution.IV Edition, (Jones and Barlett publishers Inc., 2008) Pages 760.
10. R.L. Kotpal. Modern Text Book of Zoology: Invertebrate 10thEdition. (Rastogi Publications, New Delhi, 2003).
11. Dhami. Invertebrate Zoology 10thEdition.(New Delhi, R. Chand & Company, 2003)
12. E.L. Jordan. Invertebrate Zoology 12thEdition. (S Chand & Co Ltd, India, 2013) Pages 848.

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B.Sc. Zoology Semester I

Course Code and title: MN-BZT23-102 Cell Biology and Genetics(Minor)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. To learn the cells and cell organelles.
2. To explain various cell organelles.
3. To sketch and label figures of cell organelles.
4. To learn about Genetics.
5. To explain various terms of Genetics.
6. To sketch and label various figures related to Genetics.

Topic No.		Lectures
	Credit – I	
1.	**Structure and Function of Cell -** Cell theory and diversity in cell size and shape **Structure and Function of Nucleus -** Nuclear membrane, Chromatin and Nucleolus. **Structure of and Function Chromosome-** Nucleosome concept and Polytene Chromosome.	10
2.	**Ultra Structure and Functions of** Plasma membrane (Fluid Mosaic Model), Mitochondria, Endoplasmic Reticulum, Golgi complex and Lysosomes**.**	5
	Credit –II	
3.	**Introduction to Genetics -** Mendel's work on transmission of traits, Genetic variation and Molecularbasis of Genetic variation. **Mendelian and Neo Mendelian Genetics -** Principles of Inheritance, Incomplete dominance and Co-dominance, Gene Interaction, Multiple Alleles (ABO blood groups, Rh factors and Coat colour in Rabbit) and Sex linked inheritance.	10
4.	**Mutations-** Chromosomal Mutations: Structural and Numerical changes, Euploidy and Aneuploidy, Induced Gene Mutation. **Genetic Counseling**	5

Course Outcomes: Student should be able to……

1. Define cells and cell organelles.
2. Explain various cell organelles.
3. Sketch and label figures of cell organelles.
4. Learn about Genetics.
5. Explain various terms of Genetics.
6. Sketch and label various figures related to Genetics

Reference Books:

1. De Robertis EDP and De Robertis EME – Cell and Molecular Biology
2. C.B. Powar – Cell biology , Himalaya Pub.House
3. Cell biology –Dr. N .Arumugam
4. Genetics by P.P.Meyyam
5. P.S.Verma &V. K. Agarwal-Cell biology , genetics , molecular biology, Evolution and Ecology
6. P.K. Gupta – Cell and Molecular Biology
7. VermaP.S.andAgarwal V .K. – Genetics , S. Chand andcompany
8. Strickberger – Genetics. C Millian publications
9. Winchester –Genetics Oxfordpublication
10. R.P. Meyyan , N , Arumugam – Genetics &Evolution
11. Gardner , E.J., Simmons , M.J., Snustad , D.P.(2008), Principles of Genetics ,VIII Edition ,WileyIndia.
12. Snustad , D.P. Simmons, M.J. (2009), 'Principles of Genetics', V Edition , JohnWiley and SonsInc.
13. Klug , W .S ., Cummings , M.R. Spencer ,C.A.(2012),Concepts of Genetics. X Edition, Benjamin Cummings.
14. Russell , P.J.(2009), Genetics A Molecular Approach III Edition.Benjamincummings.
15. Griffiths , A.J.F. , Wessler , S.R. Lewontin , R.C. and Carroll , S.B. introductionto Genetic Analysis. IX Edition , W.H. Freeman and Co

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B.Sc. Zoology Semester I

Course Code and title: MN-BZP23-103(Practical) Practicals Based on

Animal Diversity-I & Cell Biology and Genetics (Minor)

Credits: 02 **Total Practicals: 15**

Sr. No.	Name of the Experiment	Number of practical
1.	**Study of the following Phyla with respect to classification and morphological peculiarities.-I. Protista:** *Amoeba, Euglena, Plasmodium, Paramoecium* **ii. Porifera:** Sycon, *Hyalonema* and *Euplectella*, Bath sponge **iii. Coelenterata:** Obelia, *Physalia, Aurelia, Tubipora* and *Metridium* **iv. Platyhelminthes:** *Taenia solium*.. **v. Nemathelminths:** *Ascaris lumbricoides*, **vi.Annelida:** *Aphrodite, Nereis, Pheretima, Hirudinaria* **vii.Arthropoda:** *Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis* **viii.Mollusca:** *Chiton, Dentalium ,Pila ,Unio, Loligo, Sepia,, Octopus* **ix.Echinodermata:** *Pentaceros ,Ophiura, Echinus, Cucumaria and Antedon*,	01
2.	**Study of the following:** i.T.S. and L.S. of Sycon. ii. Life cycle and parasitic adaptations of *Taenia* and *Ascaris*.	01
3.	Culture of Protozoa (Paramoecium culture)	01
4.	Preparation of portable vermicompost unit and economic importance of vermicompost.	01
5.	Preparations of Haemin and Hemochromogen crystals.	01
6.	Cytological Preparations of Mitochondria –Stained preparation of mitochondria from Oral mucosa by using Janus Green B.	01
7.	Cytological Preparations of Polytene Chromosome – Stained preparation of polytene chromosome of Chironomus larva / Drosophila larva.	01
8.	Separation of nucleus from sheep liver by differential centrifugation method.	01
9.	Study of life cycle of Drosophila.	01
10.	Study of phenotypic variation in Drosophila (Wing and eye mutant)	01
11.	Human Genetics – Widows peak, Tongue roller, Ear lobes and	01

	Hypertrichosis.	
12.	Study of Mendelian Inheritance: Monohybrid ratio, Dihybrid ratio, Incomplete dominance, Codominance and Multiple alleles.	01
13.	Study of Human Karyotypes.	01
14.	Study of Human Genetic traits.	01
15.	Study of Human Genetic traits.	01

B.Sc. Zoology Semester I

Course Code and title: GE-BZT23-101 Public Health and Hygiene(Generic Elective)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. To learn the essentials of public health and sanitation the by warding off diseases and uplifting the living standards of the community.
2. To learn the adulteration of food.
3. To understand the ill effects of modern lifestyle
4. To learn disease and their mode of transition.
5. To study the advantages of being hygienic.

Topic No.		Lectures
	Credit – I	
1.	**Health Education:** Definition, objectives, principles and methods of health education, ill effects of smoking, alcoholism and drug. Population control and family welfare, use of contraceptives. **Adulteration of food:** foodhygiene–hygieneofmilk,meat,fish,eggs,fruitsandvegetables,common food adulterants – harmful effects and their detection, food additives, fortification of food; Food Adulteration Act and its stringent implementation.	10
2.	**Hygiene:** Definition, personal hygiene- body odor, oral hygiene, grooming, feminine hygiene, sleep hygiene, hand washing, toiletry. Social hygiene – clean living movements, occupational hygiene, food and cooking hygiene, medical hygiene.	5
	Credit –II	
3.	**Health Hazards:** Health dynamics – definition, factors influencing health, health as a medium of socioeconomic development. Diseases–Common food borne and water borne diseases (gastroenteritis, jaundice, cholera, salmonellosis, travellers' diarrhea and *Escherichia coli* infection, typhoid) – mode of transmission, causative agents, symptoms, prevention and control.	7
4.	Sexually transmitted diseases – AIDS, genital herpes, Syphilis, Gonorrhoea – causative agents, symptoms, modes of transmission and prevention. Mosquito borne diseases- Dengue, chikunguniya, rat fever (general methods of mosquito control and the need to preventmosquitobreedingin andaround our homes).	8

	Lifestyle habits – excessive usage of T.V., computer, mobile phones, two wheelers, and their impacts on health. Lack of physical exercise and its deleterious effects on the body and mind. Importance of yoga and meditation for mental and physical health.	

Course Outcomes: Students should be able to…

1. Learn the essentials of public health and sanitation there by warding off diseases and up lifting the living standards of the community.
2. Learn the adulteration of food.
3. Understand the ill effects of modern lifestyle
4. Learn disease and their mode of transition.
5. Study the advantages of being hygienic.

References

1. Jatin V. Modi and Renjith S. Chawan. Essentials of Public Health and Sanitation –PartI-IV.
2. Murray, C. J. L. and A.D. Lopez. (1996). The Global Burden of Disease. World Health Organization.
3. Park,J.E.andPark,K. Textbook of Community Health for Nurses.
4. SwaminathanS. Principles of Nutrition and Dietetics.

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B.Sc. Zoology Semester I

Course Code and title: GE-BZT23-102 Medical and Forensic Zoology (Generic Elective)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. To understand the scope, need and History of Forensic Science.
2. To understand the role of different institutes & allied institutes of Forensic Science.
3. To understand the various branches of Forensic Sciences from Life Sciences.
4. To understand human physiology, post mortal investigations.
5. To understand knowledge of handling different types of evidences and their examinations.

Topic No.		Lectures
	Credit – I	
1.	**Introduction to medical zoology and its importance** **Medico-legal Autopsy**: Death and its Causes- External examination of deceased body – Internal Examination - Determination of time since death and cause of death. Injuries – Classification - Medico-legal aspects of injuries. Post-mortem changes - collection of post-mortem samples and Preservation.	6
2.	**Infectious Diseases:** Urine Analysis: Physical characteristics, abnormal constituents, renal failure, renal calculi, dialysis. **Non infectious Diseases:** Causes, Types, Symptoms, Complications, Diagnosis and Prevention of Diabetes (Type I and II), Hypertension, Hypotension, Obesity, Atherosclerosis, Myocardial Infarction.	9
	Credit –II	
3.	**Introduction to Forensic Zoology:** Definition, Scope and Application of Forensic Zoology. Forensic Laboratories in India. Basic Principles of Forensic Science with Examples. **Forensic Medicine:** Introduction to Forensic Medicine: Definitions of Forensic Medicine**,** Medical Jurisprudence. Medical evidence documentations.	6
4.	**Forensic Analysis: Examination of Biological Materials**: **Forensic Importance of Insects**: Forensically importance insects, indicators of time of death stages of insect development & comparative decomposition of human body - colonization - Evidence collection of insects. **DNA Fingerprint Technique and Examination of Biological Traces:** Liquid blood, blood stains, & swabs, semen, Seminal stains, tissues, Bones, Hairs, Teeth, Saliva, Skeletal remains. **Toxicological Investigations**:	9

	Poisons – Definition, Forms of Poison –Physical, Chemical & Mechanical state. Introduction with examples of –Neurotoxic Poisons – Cerebral & Spinal, Cardiovascular Poisons, Asphyxiants, and Miscellaneous poisons – Pesticides, Pharmaceutical drugs, Petroleum poisons, Food poisons, radioactive poisons**.**	

Course Outcomes: Student should be able to……

1. Understand the basics principles of Medical and Forensic Zoology.
2. Understand scientific methods in crime detection.
3. Understand the advancements in the field of Medical and Forensic Zoology.
4. Understand modern tools, techniques and skills in forensic investigations.
5. Describe the fundamental principles and functions of forensic science and its significance to human society.

Reference Books

1. Godkar P. B and Godkar D. P, Textbook of Medical Laboratory Technology, II Edition, BhalaniPublications
2. Textbook of Microbiology: R. Ananthanarayan, C. K. JayaramPanikar, University Press.
3. A textbook of Microbiology: P. Chakraborty
4. Text book of pathology: Robbins &Cotran, Vol. 1 & 2, Tenth Edition, Elsevier Publication.
5. Pathologic basis of disease: M. K. Singh &Vinay Kumar, Vol. 1 & 2, 10th edition, Elsevier.
6. Text book of General pathology: Bhende & Deodhare Part I & II.
7. Pathologic basis of Disease: Robbins & Cotran, Vol. 1 & 2, 10th edition, Elsevier publications.
8. Essentials of medical pharmacology: K. D. Tripathi, 8th edition, Jaypee brothers publishers.
9. Review of pharmacology: K. D. Tripathi, Jaypee brothers publication.

B.Sc. Zoology Semester I

Course Code and title: GE-BZP23-103 Practicals Based on Public Health and Hygiene & Medical and Forensic Zoology (General Elective)

Credits: 02 **Total Lectures: 30**

Sr. No.	Name of the Experiment	Number of practical
1.	Detection of presence of adulterants in fat oil and butter.	01
2.	Detection of presence of adulterants in sugar.	01
3.	Detection of presence of sample of chilly power, turmeric powder and paper.	01
4.	Contraceptives used in birth control and sexually transmitting diseases.	01
5.	Mosquito born diseases and their control	01
6.	Effects of alcohol/drug/tobacco on development of chick embryo.	01
7.	Study of food born disease.	01
8.	Study of water born disease	01
9.	Study of body mass index.	
10.	Examination of food for the presence of microorganism by the method of direct microscopic count (DMC).	01
11.	Study of AIDS, genital herpes, hepatitis B, syphilis, gonorrhea.	01
12.	Detection of microbes from water sample.	
13.	Good hygiene practices.	01
14.	Practice of yoga and meditation.	
15.	Field visit to industry/nature.	01
16.	Examination of Biological Materials: Examination of Hair, Fibers materials, human tissues.	01
17.	Examination of Biological Materials: Diatoms, plants.	01
18.	Examination of Body Fluid: Blood, Semen and Saliva.	01
19.	Forensic Importance of Insects.	01

20.	Isolation of DNA from animal tissue	01
21.	Detection blood by haemin crystal	01
22.	Detections of semen sample	01
23.	Detection of heavy metals from body fluid by AAS	01
24.	Detections of poisons from food	01
25.	Study of Death stages of insect development	
26.	Study of comparative decomposition of human body.	
27.	Study of Physical characteristics, abnormal constituents of urine.	
28.	DNA Fingerprint Technique and Examination of Biological Traces	
29.	Toxicological Investigations: Poisons: Neurotoxic Poisons, Food poisons, radioactive poisons**.**	
30.	Visit to any forensic laboratory	

B.Sc. Zoology Semester I

Course Code and title: IKSZ23-101 Health and Well Being in Indian Knowledge System

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. To learn the knowledge about the ancient Ayurveda techniques.
2. To understand the importance of Ayurveda in routine life.
3. To learn the traditional Yoga practices for better health and well-being.
4. To acquire the knowledge of Meditation and breathing.
5. To understanding the ayurvedicPanchakarma technique

Topic No.		Lectures
	Credit – I	
1.	**Ayurveda**- History of Ayurveda, Panchamahabhuta and Tridosha techniques, Traditional Ayurvedic therapies, Applications of Ayurveda, Scope of Ayurveda	8
2.	**Panchakarma**- History of Panchakarma, Importance of Panchakarma, Five procedures of Panchakarma, Panchakarma practices and applications.	7
	Credit –II	
3.	**Yoga Practices -** Seven spiritual laws of Yoga, Yoga Asanas and Importance, Sudarshan Kriya, Yoga practices in day to day life.	7
4.	**Meditation and Breathing-** Meditation- Calming a turbulent mind, Moving energy – Pranayama and Bandhas, Thought Cycle, Chakra Meditations- Seven Chakras of meditation, Thought awareness, Attention and Intention of meditation.	8

B.Sc. Zoology Semester II

Course Code and title: MJ-BZT23-201Animal Diversity-II (Major)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. To acquire knowledge of biology in diversity of organism.
2. To able to explain and apply the fundamental concepts of animal diversity.
3. To make communicate scientific in formation
4. To able to explain characteristics and classification

Topic No.		Lectures
	Credit – I	
1.	**Protochordates:** General features and Retrogressive metamorphosis in Ascidian tadpole (Eg.Herdmania) **Agnatha:** General features of Agnatha and classification of cyclostomes up to classes.	7
2.	**Pisces:** General features and Classification up to order: Swim bladder, parental care in fishes. **Amphibia:** General features and Classification up to order: Neoteny and Parental care in Amphibia (Order:Anura, Apoda, Urodela) Icthyophis	8
	Credit -II	
3.	**Reptiles:** General features and Classification up to order: Venomous and non-venomous Snakes, Biting mechanism in snakes. First Aid Treatment, Sources of treatment, (Govt. hospitals) Information of Haffkin institute.	7
4.	**Aves:** General features and Classification up to order: Brain of fowl, Aerial Adaptations in birds (Morphological, Anatomical and Physiological).**Mammals:** General features and Classification up to order: Study of Adaptive radiations in mammals, (Duck Billed Platypus, Kangaroo, Bottle nose Dolphin, Blue Whale, Scaly ant eater, Spiny ant eater).	8

Course Outcomes: Student should be able to……..

1. Learn about classification and general characters of animals.
2. Learn difference between venomous and non-venomous snake.
3. Learn to apply treatment for snakebite.
4. Learn to classify animals up to orders.

References:

1. Chordate Zoology-Jhordan&Verma – (Unit1)

2. Chordates- V.S.Verma- S.Chand Publication- (Unit1)

3. Vertebrate Zoology- P.S.Dhami- S.Chand Publication (Unit 1 &2)

4. Modern textbook of Zoology- Vertebrates 2nd edition- R.L.Kotpal – Rastogi Publication (Unit-2)

5. Zoology of chordates- Nigam- (Unit 1)

6. Fundamental of Zoology-Verma and Dudhane (Unit2)

7. Practical Zoology –Vertebrates-R.L.Kotpal (Unit1,2)

8. Manual of Practical Zoology –Chordates-P.S.Verma (Unit1)

9. Textbook of Zoology- S.S.Lal (Unit1,2)

10. Vertebrate Zoology –R.L.Kotpal (Unit1,2)

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B.Sc. Zoology Semester II

Course Code and title: MJ-BZT23-202 Animal Physiology (Major)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. Learn animals with different phyla, their distribution and their relationship with the environment.
2. Develop practical skill in various hematological practical.
3. Explain importance of health and hygiene.
4. Differentiate of bloods of difference species depending upon the shape of the crystal.

Topic No.		Lectures
	Credit – I	
1.	**Nerve and muscle :** Structure of a Neuron, Resting membrane potential, Origin of Action Potential and its propagation in Non-myelinated nerve fibers, Ultra-structure of skeletal muscle, Molecular and Chemical basis of muscle contraction	9
2.	**Digestion:** Physiology of digestion; Absorption of Carbohydrates and Lipids	6
	Credit -II	
3.	**Respiration:** Pulmonary ventilation, Transport of Oxygen and Ca in blood. **Excretion:** Structure of Nephron, Mechanism of urine f Counter – Current Mechanism.	6
4.	**Cardiovascular system**: Composition of blood, Structure of heart, Origin and conduction of the Cardiac impulse and Cardiac cycle. **Blood Pressure:** Measurement of Systolic and Diastolic pressure, Cardiac output. **ECG measurement:** Physiological measurement and significance	9

Course Outcomes: Student should be able to ……

1. Define the digestion and absorption in alimentary canal in human.
2. Describe the mechanism of pulmonary ventilation and urine formation.
3. Apply special assessment techniques which may be used in the physical examination of the cardiovascular system, including blood pressure and electrocardiogram (ECG).
4. Interpret the reproductive physiology of male and female

References:-

1. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution .IV Edition, Jones and Barlett publishers Inc.Tortora ,G.J. and Derrickson , B.H.(2009). Principles of Anatomy and Physiology,XI Edition ,John Wiley & Sons , Inc.
2. Widmaier, E.P.,Raff , H. and Strang , K.T.(2008) Vander's Human Physiology , XI Edition, McGrawHill
3. Guyton, A.C. and Hall, J.E.(2011). Textbook of Medical Physiology, XII Edition ,Harcourt Asia Pvt .Ltd /W.B. Saunders Company.

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B.Sc. Zoology Semester II

Course Code and title: MJ-BZP23-203 Practicals Based on Animal Diversity-II &Animal Physiology (Major)

Credits: 02 **Total Lectures: 30**

Sr. No.	Name of the Experiment	Number of practical
1.	**Study of the following specimens with reference to morphological peculiarities and classification-i. Protochordates:** Herdmania, Branchiostoma, **ii.Agnatha:** Petromyzon **iii.Pieses :**Hammer headed shark**,** Saw fish, Electric ray,Labeo, Exocoetus, Anguilla **iv. Amphibia:** Ichthyophis**,** Salamandra, Bufo, Hyla. **v. Reptiles:** *Chelone, Hemidactylus, Chamaeleon, Draco, Crocodylus* **vi. Aves:** Parrot, Woodpeaker, Horned, owl, Vulture, Sparrow, Pigeon, **vii.Mammals:** *Sorex, Pipistrellus pipistrellus, Funambulus and Nycticebus bengalensis.*	01
2.	Characters identifying venomous and non-venomous snakes: Russell's viper,Saw scaled viper, Common krait, Indian Cobra, Sea snake, Rat snake and checkered keel back, Sand boa.	01
3.	Dissection of brain of fowl.	01
4.	Temporary preparation of Hyoid apparatus, Sclerotic plate, Pecten of fowl.	01
5.	Temporary preparation of Cycloid, Ctenoid and Placoid scales in fishes.	01
6.	Adaptations in reptiles: Phyrenosoma, Chameleon, Crocodile, Walllizard	01
7.	Bleeding and clotting time	01
8.	Determination of Grip strength	
9.	Measurement of Blood Pressure by Sphygmomanometer.	01
10.	Recording of ECG.	01
11.	Measurement of lung capacity by using peak flow meter.	01
12.	Analysis of ABO blood groups and Rh factor.	01
13.	Study of osmotic phenomenon or permeability in red blood cells.	01

14.	Determination of hemoglobin (Hb) by using Sahli's Haemoglobinometer.	01
15.	Review article/work experience/project/visit	01

B.Sc. Zoology Semester II

Course Code and title: MN-BZT23-201Animal Diversity-II (Minor)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. To acquire knowledge of biology in diversity of organism.
2. To able to explain and apply the fundamental concepts of animal diversity.
3. To make communicate scientific in formation
4. To able to explain characteristics and classification

Topic No.		Lectures
	Credit – I	
1.	**Protochordates:** General features and Retrogressive metamorphosis in Ascidian tadpole (Eg.Herdmania)**Agnatha:** General features of Agnatha and classification of cyclostomes up to classes.	7
2.	**Pisces:**General features and Classification up to order: Swim bladder, parental care in fishes.**Amphibia:** General features and Classification up to order: Neoteny and Parental care in Amphibia (Order:Anura, Apoda, Urodela) Icthyophis	8
	Credit –II	
3.	**Reptiles:** General features and Classification up to order: Venomous and non-venomous Snakes, Biting mechanism in snakes. First Aid Treatment, Sources of treatment, (Govt. hospitals) Information of Haffkin institute.	7
4.	**Aves:** General features and Classification up to order: Brain of fowl, Aerial Adaptations in birds (Morphological, Anatomical and Physiological).**Mammals:** General features and Classification up to order: Study of Adaptive radiations in mammals, (Duck Billed Platypus, Kangaroo, Bottle nose Dolphin, Blue Whale, Scaly ant eater, Spiny ant eater).	8

Course Outcomes: Student should be able to……..

1. Learn about classification and general characters of animals.
2. Learn difference between venomous and non-venomous snake.
3. Learn to apply treatment for snakebite.
4. Learn to classify animals up to orders.

References:

1. Chordate Zoology-Jhordan&Verma – (Unit1)

2. Chordates- V.S.Verma- S.Chand Publication- (Unit1)

3. Vertebrate Zoology- P.S.Dhami- S.Chand Publication (Unit 1 &2)

4. Modern textbook of Zoology- Vertebrates 2nd edition- R.L.Kotpal – Rastogi Publication (Unit-2)

5. Zoology of chordates- Nigam- (Unit 1)

6. Fundamental of Zoology-Verma and Dudhane (Unit2)

7. Practical Zoology –Vertebrates-R.L.Kotpal (Unit1,2)

8. Manual of Practical Zoology –Chordates-P.S.Verma (Unit1)

9. Textbook of Zoology- S.S.Lal (Unit1,2)

10. Vertebrate Zoology –R.L.Kotpal (Unit1,2)

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B.Sc. Zoology Semester II

Course Code and title: MN-BZT23-202 Animal Physiology (Minor)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. Learn animals with different phyla, their distribution and their relationship with the environment.
2. Develop practical skill in various hematological practical.
3. Explain importance of health and hygiene.
4. Differentiate of bloods of difference species depending upon the shape of the crystal.

Topic No.		Lectures
	Credit – I	
1.	**Nerve and muscle :** Structure of a Neuron, Resting membrane potential, Origin of Action Potential and its propagation in Non-myelinated nerve fibers, Ultra-structure of skeletal muscle, Molecular and Chemical basis of muscle contraction	9
2.	**Digestion:** Physiology of digestion; Absorption of Carbohydrates and Lipids	6
	Credit –II	
3.	**Respiration:** Pulmonary ventilation, Transport of Oxygen and Ca in blood. **Excretion:** Structure of Nephron, Mechanism of urine f Counter – Current Mechanism.	6
4.	**Cardiovascular system**: Composition of blood, Structure of heart, Origin and conduction of the Cardiac impulse and Cardiac cycle.**Blood Pressure:** Measurement of Systolic and Diastolic pressure, Cardiac output. **ECG measurement:** Physiological measurement and significance	9

Course Outcomes: Student should be able to ……

1. Define the digestion and absorption in alimentary canal in human.
2. Describe the mechanism of pulmonary ventilation and urine formation.
3. Apply special assessment techniques which may be used in the physical examination of the cardiovascular system, including blood pressure and electrocardiogram (ECG).
4. Interpret the reproductive physiology of male and female

References:-

4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution .IV Edition, Jones and Barlett publishers Inc.Tortora ,G.J. and Derrickson , B.H.(2009). Principles of Anatomy and Physiology,XI Edition ,John Wiley & Sons , Inc.
5. Widmaier, E.P.,Raff , H. and Strang , K.T.(2008) Vander's Human Physiology , XI Edition, McGrawHill
6. Guyton, A.C. and Hall, J.E.(2011). Textbook of Medical Physiology, XII Edition ,Harcourt Asia Pvt .Ltd /W.B. Saunders Company.

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B.Sc. Zoology Semester II

Course Code and title: MN-BZP23-203 Practicals Based on Animal Diversity-II & Animal Physiology (Minor)

Credits: 02 **Total Lectures: 30**

Sr. No.	Name of the Experiment	Number of practical
1.	**Study of the following specimens with reference to morphological peculiarities and classification-i. Protochordates:** Herdmania, Branchiostoma, **ii.Agnatha:** Petromyzon **iii.Pieses :**Hammer headed shark**,** Saw fish, Electric ray, Labeo, Exocoetus, Anguilla **iv. Amphibia :** Ichthyophis**,** Salamandra, Bufo, Hyla. **v. Reptiles :***Chelone, Hemidactylus, Chamaeleon, Draco, Crocodylus* **vi. Aves:** Parrot, Woodpeaker, Horned, owl, Vulture, Sparrow, Pigeon, **vii. Mammals:** *Sorex, Pipistrellus pipistrellus, Funambulus and Nycticebus bengalensis.*	01
2.	Characters identifying venomous and non-venomous snakes: Russell's viper, Saw scaled viper, Common krait, Indian Cobra, Sea snake, Rat snake and checkered keel back, Sand boa.	01
3.	Dissection of brain of fowl.	01
4.	Temporary preparation of Hyoid apparatus, Sclerotic plate, Pecten of fowl.	01
5.	Temporary preparation of Cycloid, Ctenoid and Placoid scales in fishes.	01
6.	Adaptations in reptiles: Phyrenosoma, Chameleon, Crocodile, Walllizard	01
7.	Bleeding and clotting time	01
8.	Determination of Grip strength	
9.	Measurement of Blood Pressure by Sphygmomanometer.	01
10.	Recording of ECG.	01
11.	Measurement of lung capacity by using peak flow meter.	01
12.	Analysis of ABO blood groups and Rh factor.	01
13.	Study of osmotic phenomenon or permeability in red blood cells.	01

14.	Determination of hemoglobin (Hb) by using Sahli'sHaemoglobinometer.	01
15.	Review article/work experience/project/visit	01

B.Sc. Zoology Semester II

Course Code and title: GE-BZT23-201 Food Nutrition and Dietetics (Generic Elective)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. To understand the functions and role of nutrients, their requirements and effect of deficiency and excess.

2. To understand the concept of an adequate diet and the importance of nutrients in recommended dietary allowance.

Topic No.		**Lectures**
	Credit – I	
1.	Definition of food, nutrition, health, Nutraceuticals and Notrigenomics Dimension of health and function of food- Physical, Social and mental health. Energy requirements Factors affecting energy requirements**,** BMR-activity, age, Physiological conditions	9
2.	Macro Nutrients Protein, Carbohydrate, Fat-Classification, functions, Digestionand absorption. Functional foods Phytonutrients: Phytates. Tannins and Polyphenols, their sources and function	6
	Credit –II	
3.	Micronutrients, Calcium, Phosphorus and magnesium: Functions, absorption.Macro minerals deficiencies, Micro Minerals: Iron, Zinc, Fluorine and lodine: function, absorption, RDA, sources. Vitamins: Fat-soluble Vitamins (A, D, E &K), Function, sources and deficiency and excess. Water soluble vitamins: Thiamine, Riboflavin, Niacin, B12, Folic acid, Biotin, Vitamin C: functions, RDA, food sources, deficiencies and excess.	10
4.	Water and Electrolytes. Water: Functions, requirements, sources, water balance, Electrolyte and acid base balance: Electrolyte- Sodium, Chloride, Potassium, function.	5

Course Outcomes: Student should be able to ……

1. Apply basic nutrition knowledge in making food choices and obtaining an adequate diet
2. Understand the functions and role of nutrients, their requirements and effect of deficiency and excess.

References :

1. AntiaF.P.. Philip Abraham, Clinical Dietetics and Nutrition. Oxford University4 edition.Press.
2. Kathleen Mahan L., SylniaEscott-Stump, Krause's food, nutrition and diet therapy (11 edition). Saunders company, London
3. Passmore R. and Davidson S. (1986) Human nutrition and Dietitics.Liming stone Robinson C.H. Careme, Chenometh W.L. Garmick A.E. (1986) 16 edition Normal publishers.
4. Therapeutic nutrient. Publish by McMillan Company New York.
5. Shil's M.E., AlfonJ.A..Shike M (1994), Modern nutrition in health and diseases eighth edition.
6. William S.R., Nutrition and Diet Therapy fourth edition C.V. Mos Company

B.Sc. Zoology Semester II

Course Code and title: GE-BZT23-202 Freshwater Aquaculture (Generic Elective)

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. Identify various species of fresh water fishes, ornamental fishes and prawns.
2. Knowledge of fish culture breeding techniques and its economic importance.
3. Knowledge of prawn culture techniques and its economic importance.
4. Knowledge of pearl culture techniques and its economic importance.
5. Knowledge of ornamental fish culture breeding techniques and its economic importance

Topic No.		Lectures
	Credit – I	
1.	**Scope and systems of Aquaculture** **Introduction:** Present status, problems and scope of fish farming in global and Indian perspective. Aquaculture systems: Extensive, semi-intensive and intensive culture of fish, Pen and cage culture in lentic and lotic water bodies, polyculture, composite fish culture. **Fish farming:** Nursery and grow-out, pond preparation, stocking, feeding and water quality management in the farming of major and minor carps. Stunted seed production and culture practice.	8
2.	**Freshwater prawn farming:** Monoculture practice of prawn in ponds, all male culture and its advantages, polyculture with carp. Nursery rearing, sex segregation, pond preparation, stocking, Feeding and water quality management, disease prevention and treatment; harvesting and handling.	7
	Credit -II	
3.	**Pearl Culture:** Introduction of Pearl-producing molluscs. Natural Process of Pearl formation. Chemical composition of Pearls. Economic importance of pearls. Techniques of pearl oyster culture for artificial production of pearls. Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery, Post- operative culture, harvesting of pearl, clearing of pearl.	8

4.	**Ornamental Fish culture:** Global status of ornamental fish trade. Design & construction of aquarium, garden pool, Captive Breeding techniques of commercially important freshwater ornamental fishes. Common aquarium plants and invertebrates. Gadgets used in freshwater aquarium. Value addition: Color enhancement through pigmented feed. Prerequisite for establishment of ornamental fish breeding, cultureunit for entrepreneurship development.	7

Course Outcomes: Student should be able to ……

1. Modernize the activities relating to fisheries and aquaculture for focused attention and professional management.
2. Improve production, processing, storage, transport and marketing of fish products within the country and exporting it.
3. Generate substantial employment in fishery sciences.
4. Train and self employment to empower women in fishery science to empower nation.
5. Enhance contribute of fish towards food and nutritional values added for mankind.

References:

1. AAHRI. 1998. Health Management in Shrimp Ponds. Aquatic Animal Health Research Institute (AAHRI), Department of Fisheries, Thailand. Agarwal SC. 2008.
2. A Handbook of Fish Farming. 2nd Ed. Narendra Publ. House. Beveridge MCM &Mc Andrew BJ. 2000. Tilapias: Biology and Exploitations. Kluwer. De Silva SS. (Ed.). 2001.
3. Reservoir and Culture Based Fisheries: Biology and Management. ACAIR Proceedings. FAO. 2007. Manual on Freshwater Prawn Farming. Midlen& Redding TA. 1998.
4. Environmental Management for Aquaculture. Kluwer. New MB. 2000.
5. Freshwater Prawn Farming. CRC Publ. Pillay TVR. 1990.
6. Aquaculture: Principles and Practices. Fishing News Books, Cambrige University Press, Cambridge. Venugopal S. 2005.
7. Aquaculture. Pointer Publ. UjwalaJadhav (2010): Aquaculture Technology and Environment. Publ. PHI Publication Welcomme RL. 2001.
8. Inland Fisheries: Ecology and Management. FishingNews Books

B.Sc. Zoology Semester II

Course Code and title: GE-BZP23-203 Freshwater Aquaculture (Generic Elective)

Credits: 02 **Total Lectures: 30**

Sr. No.	Name of the Experiment	Number of practical
1.	Weights and measures.	01
2.	Standardization of recipes.	01
3.	Introduction to Recommended Dietary Allowances Nutritive value of foods.	01
4.	Calculation of energy balance among college going girls.	01
5.	Enhancing the traditional recipes with specific nutrients protein	01
6.	Enhancing the traditional recipes with specific nutrients Carbohydrate	01
7.	Enhancing the traditional recipes with specific nutrients Fat.	01
8.	Enhancing the traditional recipes with specific nutrientsvitaminA, vitamin C, calcium and iron).	01
9.	Calculate BMR from students.	01
10.	Visit to analytical lab for demonstration of protein and fat estimation.	01
11.	Deficiency diseases of vitamins and minerals.	01
12.	Deficiency diseases of carbohydrates.	01
13.	Deficiency diseases of proteins.	01
14.	Deficiency diseases of fats.	01
15.	Any other practical set by department	01
16.	Identification of common freshwater fishes.	01
17.	Water analyses (pH/dissolved oxygen/Free CO_2 /alkalinity/ hardness)	01

18.	Fish feed formulation	01
19.	Fish color enhancement through pigmented feed	01
20.	Fish farming Techniques	01
21.	Culture technique of planktons for pond maintenance.	
22.	Pearl Culture Surgical techniques-Graft tissue preparation, implantation techniques, post operation care	
23.	Designed pearl culture techniques, bleaching, collection of pearls, cleaning of pearls	
24.	Sorting of pearls, marketing of pearls.	
25.	Prawn Culture Techniques.	
26.	Identification of common ornamental fishes.	
27.	Study of gadgets used in construction of Aquarium	
28.	Construction of Aquarium	
29.	Economic importance of aquaculture	
30.	Visit to Fish farm, Prawn farm, Pearl culture farm, Aquarium center.	

B.Sc. Zoology Semester II

Course Code and title: SECZ23-201 Vermitechniques and Vermicomposting

Credits: 02 **Total Lectures: 30**

Course Objectives:

1. To build an interest about Vermicomposting, Vermiwash&Vermiculture among the students
2. To build entrepreneurship skills among the students
3. To encourage students about culture & management of Earthworms
4. To encourage the students for organic farming with the help of vermitechnology.
5. To aware the students about diseases and pests of Earthworm.

Topic No.		Lectures
	Credit – I (Theory)	
1.	**Introduction:** Vermicomposting: Introduction and Scope, History, their value in maintenance of soil structure, role as four r's of recycling: reduce, reuse, recycle, restore. Types of Earthworm and Classification Epigeic, Endogeic, Dingeic species. Useful species of earthworms. Life history of Earthworms (Earthworm Species: *Eisenia foetida/ Eudrillus euginae*) Objectives of Vermicompost. Methods of Vermicomposting: Small and large scale Bed method, Pit method. Vermicompost Production: Establishment of Vermicomposting and Vermiwash unit Pests and diseases of Earthworms.	8
2.	Management of vermicompost method, Harvesting the Compost & Vermiwash Storage and packaging of vermicompost, Physico-chemical analysis of vermicompost. Components of vermicompost and their role in agriculture, Importance and use of vermicompost, Importance & use of vermiwash, Marketing & awareness for farmers by organising farmers meet.	7
	Credit –II (Practical)	
1.	Classification of Earthworm	01
2.	Study of Species of Vermitechnology	01
3.	Study of external morphology and habit and habitat of Earthworm-*Eiseniafoetida*	01

4.	Study of Digestive system of earthworm	01
5.	Study of Reproductive system of earthworm	01
6.	Study of cocoon and juvenile stages of earthworm.	01
7.	Study of Pests of Earthworm	01
8.	Study of diseases of Earthworm	01
9.	Establishment of vermicomposting unit: Pit method	01
10.	Establishment of vermicomposting unit: Bed method	01
11.	Establishment of vermiwash unit and	01
12.	Effect of vermiwash on crops	01
13.	Vermicompost production,	01
14.	Harvesting and packaging of Vermicompost	01
15.	Effects of vermicomposton crops.	01

Course Outcomes: Student should be able to ……

1. Students can construct their own compost in farm & can get monthly income.
2. Students farmers by using vermicompost can increase the productivity.
3. Students can produce vermicompost on small scale for garden household plants.
4. The candidate can generate income by supplying vermiculture, vermiwash, & vermicompost.
5. He/she will directly or indirectly help to reduce environmental pollution.

References:

1. PragathilshetichaRajmarg: GandulshetiDr.R.S.Dubal

2. Bhatt J.V. & S.R. Khambata (1959) "Role of Earthworms in Agriculture" Indian Council of Agricultural Research, New Delhi

3. Dash, M.C., B.K.Senapati, P.C. Mishra (1980) Verms and Vermicomposting" Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B).School of Life Sciences, SambalpurUniversity.JyotiVihar, Orissa.

4. Edwards, C.A. and J.R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd.. London. 4. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Use Academic Press, Sydney.

5. Satchel, J.E. (1983) "Earthworm Ecology" Chapman Hall, London,
8. Wallwork, J.A. (1983) "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.