



SIR P. T. SARVAJANIK COLLEGE OF SCIENCE, SURAT.  
Autonomous  
(Affiliated with Veer Narmad South Gujarat University)



Reaccredited 'A+' 3.35 CGPA by NAAC, *College with Potential for Excellence*

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# **Sir P. T. Sarvajani College of Science**

**Autonomous**

**Affiliated to Veer Narmad South Gujarat University,  
Surat**

**Re-Accredited 'A<sup>+</sup>' with CGPA 3.35**

**SYLLABUS**

**FOR**

**SEM II**

**Program: M.Sc.**

**Course: ZOOLOGY**

**For**

**Academic year**

**2024-25**

**(NEP-2020)**

**Effective from June 2024**



## Content

Sr. No	Semester	Course	Course number	Course Code	Course title
1	I	Core Course - I	CC I	ZOO MSC--S1P1- 4CR 24	Biology of Non- Chordates [Invertebrates]
2		Core Course - II	CC II	ZOO MSC -S1P2- 4CR 24	Biology of Chordates [vertebrates]
3		Core Course - III	CC III	ZOO MSC -S1P3- 4CR 24	Ecology and Ethology
4		Elective Course- I	EC-I	ZOO MSC -S1E1- 4CR 24	Apiculture
				ZOO MSC-S1E2- 4CR 24	Animal Science in Pharmaceuticals
5		Skill Based Elective Course- I	SEC-I	ZOO MSC -S1SEC1- 2CR 24	Aquaculture
6	PRACTICAL	CCP-I	ZOO MSC -S1PR1 - 6CR 24	Experimental Zoology	
1	II	Core Course - IV	CC IV	ZOO MSC—S2P1- 4CR 24	Animal physiology
2		Core Course - V	CC V	ZOO MSC –S2P2- 4CR 24	Wildlife Biology and Conservation
3		Core Course - VI	CC VI	ZOO MSC –S2P3- 4CR 24	Developmental Biology
4		Elective Course- II	EC-III	ZOO MSC –S2E3- 4CR 24	Sericulture
				ZOO MSC-S2E4- 4CR 24	Food and Nutrition
5		Skill Based Elective Course- II	SEC-II	ZOO MSC –S2SEC2- 2CR 24	Economic Entomology
6	PRACTICAL	CCP-II	ZOO MSC –S2PR1 - 6CR 24	Experimental Zoology	



**M. Sc. (Zoology) SEMESTER II**

**Core Course-IV (CC-IV)**

**ZOOLOGY PAPER ZOO MSC—S2P1- 4CR 24 THEORY**

**Course Title: Animal Physiology (Credits -4)**

<b>Course Learning Outcome</b>		
<p>At the end of this course, Students will be able to:</p> <ul style="list-style-type: none"> <li>To know about physiology of animals.</li> <li>Understand the physiology of mammals and various metabolic processes.</li> <li>Understand vital processes like Respiration and Excretion.</li> <li>Develop understanding of neurons, Nerve impulse and neuromuscular co-ordination.</li> <li>Recognize and explain the sense organs and their functions in various animals</li> <li>Explain the thermoregulation with example.</li> </ul>		
<b>Module 1</b>	<b>Introduction</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>Scopes and branches</li> <li>Thermoregulation of different animals in different ways</li> </ul>		
<p><b>Learning Outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>Information about different branches.</li> <li>Understand Thermoregulation</li> </ul>		
1.1	a) Importance and scopes of physiology b) Branches of physiology;	3L
1.2	Thermoregulation and cold tolerance a) Basic principle of metabolism b) heat balance and exchange c) Endotherm VsEctotherm;	8L
1.3	a) Counter-current heat exchanger b) Torpor, Hibernation & Aestivation c) Adaptation to very cold environments	5L
<b>Module 2</b>	<b>Ionic &amp; Osmotic Balance</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>Osmoregulation of different animals</li> </ul>		
<p><b>Learning Outcome:</b></p>		



After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>• Explain different term such as Osmoregulation, osmoconfirming, osmoregulator.</li> <li>• Compare different osmoregulator organ.</li> </ul>		
2.1	Osmoregulation vs osmoconfirming	5L
2.2	a) Osmoregulation in aquatic and terrestrial environment b) Kidney function and diversity	5L
2.3	a) Other Osmoregulatory organ b) Nitrogenous waste excretion	5L
<b>Module 3</b>	<b>Physiology of Muscular System</b>	<b>[15L]</b>
<b>Learning Objectives:</b>		
This module is intended to		
<ul style="list-style-type: none"> <li>• How muscle and nervous systems are correlated.</li> </ul>		
<b>Learning Outcome:</b>		
After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>• Evaluate different theories of muscular contraction.</li> <li>• Connect two physiology processes.</li> </ul>		
3.1	Theories of muscular contraction molecular mechanism and regulation of muscular contraction.	8L
3.2	<b>Neurophysiology:</b> Structural and functional organization of the nervous system Physical basis of neuronal function Communication along and between neuron.	7L
<b>Module 4</b>	<b>Sensory Transduction</b>	<b>[15L]</b>
<b>Learning Objectives:</b>		
This module is intended to		
<ul style="list-style-type: none"> <li>• Different Sensory organs and their functions.</li> </ul>		
<b>Learning Outcome:</b>		
After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>• Recognize and explain the sense organs and their functions in various animals.</li> </ul>		
4.1	Sensing the environment Phonoreceptor – Physiology of equilibrium	5L
4.2	Vision and Photoreceptor Chemoreceptors - Taste and Smell	5L
4.3	Machenoreceptor : Tactile Echolocation :Bats..	5L
<b>References:</b>		
1. G. J. Tortora: Principle of Anatomy and Physiology		



2. Hoar: General and Comparative physiology
3. Dr. P.V. Jabade: General Physiology
4. B. K. Berry: Animal Physiology
5. C. C. Chatterjee: Human Physiology
6. Goel and Shastri: Textbook of Animal Physiology
7. K.S. Nelson: Animal Physiology
8. Holurn: Principles of Physiology and Biochemistry
9. Bell and Davidson: Textbook of Physiology and Biochemistry
10. Withers: Comparative Animal Physiology
11. Mohan P. Arora: Animal Physiology
12. R. C. Sobti; Animal Physiology.

**Mapping CO\_PO**

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
To know about physiology of animals.	X					
Explain the thermoregulation with example.		X				
Recognize and explain the sense organs and their functions in various animals.	X					
Evaluate different theories of muscular contraction					X	
Develop understanding of neurons, Nerve impulse and neuromuscular co-ordination.	X					
Understand vital processes like Respiration and Excretion.		X				
Understand the physiology of mammals and various metabolic processes.		X				



**Core Course-V (CC-V)**

**ZOOLOGY PAPER ZOO MSC –S2P2- 4CR 24 THEORY**

**Course Title : Wildlife Biology and Conservation (Credits -4)**

<b>Course Learning Outcome</b>		
<p>At the end of this course, Students will be able to:</p> <ul style="list-style-type: none"> <li>To make the students equipped with the knowledge of wildlife resources of India having emphasis to the principles and applications of various wildlife management techniques.</li> <li>To study about economic importance of animals and health care of wild animals.</li> <li>Understand red data book, Key stone Spp., Umbrella Spp.,</li> <li>Understand biogeographic Zones of India.</li> <li>Explain Predator and prey interaction.</li> <li>Explain Lotka – Volterra model.</li> <li>Enlist all wildlife of India.</li> </ul>		
<b>Module 1</b>	<b>Conservation of Wildlife</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to</p> <ul style="list-style-type: none"> <li>Understand the evolutionary significance of different functional adaptations in different groups of invertebrates.</li> <li>Understand the interaction of invertebrates with the environment.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>Understand the basic concepts of lower animals and observe the structure and functions.</li> <li>Differentiate and classify the various groups of animal modes of life and to estimate the biodiversity.</li> </ul>		
1.1	a) Aims of wildlife conservation b) Concept of Red data Book, Keystone species, Umbrella species and Flagship species	5L
1.2	a) Conservation Strategy b) Wildlife of India c) Indian board of Wildlife	5L
1.3	a) Biogeographic zones of India b) Climate change and its effects on Wildlife.	5L
<b>Module 2</b>	<b>Predators - Prey Interactions</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b></p>		



This module is intended to		
<ul style="list-style-type: none"> <li>• Dependency of animal on each other.</li> <li>• How they interact.</li> </ul>		
<b>Learning Outcome:</b>		
After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>• Understand behavior of animal by interaction with each other.</li> <li>• Gain knowledge of interaction.</li> </ul>		
2.1	a) Behavioural ecology b) Food and feeding c) Foraging as a Major Activity of Animals	5L
2.2	a) Predation and Predator –Prey Interactions b) Lotka - Volterra Model of Predator –Prey Interactions c) Optimal Foraging Theory (OFT)	5L
2.3	a) Aggression in Response to the Availability of Food b) Food as factor Responsible for Distribution of Animals c) Mammalian Foraging and Seed Dispersal gland, Oil gland structure and function.	5L
<b>Module 3</b>	<b>Traditional Methods in Wildlife Ecology</b>	<b>[15L]</b>
<b>Learning Objectives:</b>		
This module is intended to		
<ul style="list-style-type: none"> <li>• Ecology population.</li> </ul>		
<b>Learning Outcome:</b>		
After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>• Calculation of Ecological Population.</li> <li>• Estimate biodiversity.</li> </ul>		
3.1	Ecological Monitoring Species – Area Curve	5L
3.2	Population Studies Population Estimation.	5L
3.3	Population Indices Estimating Biodiversity	5L
<b>Module 4</b>	<b>Trapping Wild Animals</b>	<b>[15L]</b>
<b>Learning Objectives:</b>		
This module is intended to		
<ul style="list-style-type: none"> <li>• Techniques for animal trapping.</li> <li>• Application of Bioelementry.</li> </ul>		



**Learning Outcome:**

After the successful completion of the module, the learner will be able to

- Aware of different technique for animal trapping.
- How DNA fingerprinting is used in wildlife.

4.1	Modern Techniques in Wildlife Ecology and Habitat Analysis Camera – Trapping	5L
4.2	Biotelemetry and Radio- tracking Remote Sensing and Geographic Information System	5L
4.3	Ecological and Conservation Genetics DNA Fingerprinting	5L

**References:**

1. Wildlife Ecology and Conservation – M. Balakrishnan
2. Wildlife Management and Conservation – M.M. Ranga
3. Ecology and Environment. P.D. Sharma

Mapping CO\_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
To make the students equipped with the knowledge of wildlife resources of India having emphasis to the principles and applications of various wildlife management techniques.	X					
To study about economic importance of animals and health care of wild animals.		X				
Understand red data book, Key stone Spp., Umbrella Spp.,		X				
Understand biogeographic Zones of India.		X				
Explain Predator and prey interaction.		X				
Explain Lotka – Volterra model.		X				
Enlist all wildlife of India.			X			



**Core Course-VI (CC-VI)**  
**ZOOLOGY PAPER ZOO MSC –S2P3- 4CR 24 THEORY**  
**Course Title: Developmental Biology (Credits -4)**

<b>Course Learning Outcome</b>		
<p>At the end of this course, Students will be able to:</p> <ul style="list-style-type: none"> <li>• Understand development of Frog .</li> <li>• Gain knowledge of Extra embryonic membranes, Regeneration and Stem cells.</li> <li>• Basic history of developmental biology.</li> <li>• Different theories of embryology.</li> <li>• Basic concept of teratology.</li> <li>• Explain and identify normal embryological anatomy and identify anomalies in development of various tissues through a comparison of normal and abnormal development.</li> </ul>		
<b>Module 1</b>	<b>Historical Review and Theories of Developmental Biology</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• History embryology.</li> <li>• Progressive history of embryology.</li> </ul>		
<p><b>Learning Outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>• Understand basic concept of development.</li> <li>• Different theories of development.</li> </ul>		
1.1	<p><b>a) Important Theories of Development</b></p> <p>Preformation Theory Epigenetic Theory Pangensis Theory Germ Layer Concept Baer’s Law</p>	7L
1.2	<p><b>B ) Biogenetic Law or Recapitulation Theory</b></p> <p>Mosaic Theory Regulative Theory.</p>	8L
<b>Module 2</b>	<b>Germ layers and Organogenesis: Organogenesis in Frog</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• Three germinal layers.</li> </ul>		



<ul style="list-style-type: none"> <li>Formation of organ from germinal layer.</li> </ul>		
<b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>Concept of fate map and organogenesis in frog.</li> </ul>		
2.1	a) Mesoderm and Coelom Formation. b) Development of Nervous System and Brain	5L
2.2	a) Development of Eye b) Development of Ear or Auditory Organ	5L
2.3	a) Development of Heart b) Development of Arterial system	
<b>Module 3</b>	<b>Teratology</b>	<b>[15L]</b>
<b>Learning Objectives:</b> This module is intended to		
<ul style="list-style-type: none"> <li>Concept of Teratogenesis.</li> <li>Embryomata and Teratomata.</li> </ul>		
<b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>Basic concept of teratogenesis.</li> <li>Understand concept of conjoined twins.</li> <li>Examine abnormal development and teratological defects to understand how and why things go wrong during development.</li> </ul>		
3.1	Stages Sensitivity of foetus in Teratogenesis Twinning and Double Monsters in Man Equal Conjoined Twins Unequal Conjoined Twins	5L
3.2	Embryomata and Teratomata Causative Factors in Teratogenesis.	5L
3.3	Malformations in the External Structures of the Body <ul style="list-style-type: none"> <li>- Malformations in Legs and Arms</li> <li>- Malformations in Hands and Feet</li> <li>- Persistence of Tail</li> <li>- Gigantism and Dwarfism</li> </ul>	5L
<b>Module 4</b>	<b>Regeneration</b>	<b>[15L]</b>
<b>Learning Objectives:</b> This module is intended to		
<ul style="list-style-type: none"> <li>Regeneration of certain organ.</li> <li>Which organ or cell can regenerate.</li> </ul>		
<b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to		



<ul style="list-style-type: none"> <li>• Understand cells responsible for regeneration.</li> <li>• Basic of regeneration.</li> </ul>		
4.1	Regeneration in Various Groups of Animal Mechanism of Regeneration - Wound Healing or Preblastema Phase - Blastema Formation	5L
4.2	Histology of Regeneration. Physiological Aspects of Regeneration Factors that Influence Regeneration	5L
2.3	Polarity in Regeneration Induction in Regeneration Regeneration Field	5L
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Foundation Of Embrology Bradley M.Patten, McGrow Publication</li> <li>2. Fertilization In Animals Brain Dale, Arlond Heiniman, Gulab Vazerani Publication</li> <li>3. Development Biology N.J. Berril, Tata McGraw Hill Publication N. Delhi</li> <li>4. Embryology Of Vertebrates - Nelson</li> </ol>		

**Mapping CO\_PO**

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• Understand development of Frog.		X				
• Gain knowledge of Extra embryonic membranes, Regeneration and Stem cells.	X					
• Basic history of developmental biology.	X					
• Different theories of embryology.	X					
• Explain and identify normal embryological anatomy and identify anomalies in development of various tissues through a comparison of normal and abnormal development.		X				
• Examine abnormal development and teratological defects to understand.		X				

**M. Sc. (Zoology) SEMESTER I**  
**Elective Course-II (EC-III)**



**ZOOLOGY PAPER ZOO MSC –S2E3 4CR 24 THEORY**

**Course Title: EC-III-Sericulture (Credits -4)**

<b>Course Learning Outcome</b>		
<p>At the end of this course, Students will be able to:</p> <ul style="list-style-type: none"> <li>• Explain the potentialities of sericulture as a source of rural employment and as an export earning enterprise.</li> <li>• Differentiate different silkworms and their host plants;</li> <li>• Determine various support systems available to strengthen sericulture; and identify the organizations involved in sericulture training and skill upgradation.</li> </ul>		
<b>Module 1</b>	<b>Introduction</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• Importance of Sericulture.</li> <li>• Employment and different courses.</li> </ul>		
<p><b>Learning Outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>• Different types of silks</li> <li>• Understand importance of sericulture.</li> </ul>		
1.1	What is sericulture? Types of silks	7L
1.2	Importance of silk industry Why Sericulture?	8L
<b>Module 2</b>	<b>Silkworm and the Family</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• Importance of silk.</li> <li>• Life cycle of silkworm.</li> <li>• Trade of silk.</li> </ul>		
<p><b>Learning Outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>• Economic importance of silk.</li> <li>• Understand life cycle of silkworm.</li> </ul>		



2.1	The Life Cycle of Silkworm,	5L
2.2	Distribution	5L
2.3	Silk and Its Trade	5L
<b>Module 3</b>	<b>Rearing Technology</b>	<b>[15L]</b>
<b>Learning Objectives:</b> This module is intended to		
<ul style="list-style-type: none"><li>• How to rear silkworm.</li></ul>		
<b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"><li>• Understand different rearing appliances.</li><li>• Know about different techniques for cleaning.</li></ul>		
3.1	Silkworm Rearing (C.S.B. proposed model rearing house). Rearing appliances, disinfection, disinfectants, bed cleaning, feeding of worms.	5L
3.2	Maintaining optimum condition of rearing, brushing, frequency of spacing, care during mounting.	5L
3.3	Mounting and mountage, process of spinning, cocoon harvesting. Rearing method: chawki rearing or young age worm rearing. Late age Silkworm rearing.	5L
<b>Module 4</b>	<b>Non-Mulberry sericulture</b>	<b>[15L]</b>
<b>Learning Objectives:</b> This module is intended to		
<ul style="list-style-type: none"><li>• Different species of silkworm used for silk formation.</li></ul>		
<b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"><li>• Analyzed about different species of silkworm.</li><li>• List taxonomy of that species.</li></ul>		
4.1	a- Different serigenous insects; b- Non mulberry silkworms (Tasar, Muga, Eri Silk) and their distribution in India and other countries. c- Taxonomy of food plants of non-mulberry silkworms; salient features of the families of non-mulberry silkworms.	8L
4.2	Disease and pest of silkworm.	7L



**References:**

1. Charsley, S.R. (1982). Culture and Sericulture. Academic Press Inc., New York, U.S.A
2. Fao Manuals- I Mulberry Cultivation. Fao Rome.
3. Foth, H.D. (1984) Fundamentals of Soil Science. 7th Edn. John Wiley & Sons, New York.
4. Ganga, G., And J. SulochanaChetty. (1991) An Introduction to Sericulture. Oxford &Ibh Publishing Company.
4. HasaoAruga (1994). Principles of Sericulture (Translated from Japanese) Oxford &Ibh Publishing Co., Pvt. Ltd. New Delhi.
5. Kichisaburo M. (1997) Moriculture – Science of Mulberry Cultivation. OXFORD & IBH
6. Krishnaswami, S.; Narasimhanna, M.N.; Suryanarayan, S.K AndKumararaj, S. (1973) Sericulture Manual-2 - Silkworm Rearing. Agriculture Service Bulletin, Fao, Rome.
7. Rajanna, L., Das, P.K., Ravindran, S., Bhogेशha, K., Mishra, R.K., Singhvi, N.R., Katiyar, R.S. And Jayaram, H. (2005) Mulberry Cultivation and Physiology. Central Silk Board, Bangalore.
8. Manual-2 - Silkworm Rearing. Agriculture Service Bulletin, Fao, Rome.
9. Jolly, M.S. Chowdhuty, S.N and Sen. (1975). Non-Mulberry Sericulture in India. Central Silk Board, Bombay, India.
4. Jolly, M.S (1998). Tasar Culture. Central Silk Board, Bangalore, India.
11. Sarkar, D.C. (1998) Eri Culture. Central Silk Board, Bangalore
1. 13. Thangavelu, K.; Chakraborty, A.K.; Bhagawati, A.K. And Isa, Md. (1998) Handbook of Mugaculture. CSB, Bangalore

Mapping CO\_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Explain the potentialities of sericulture as a source of rural employment and as an export earning enterprise.		X				
Differentiate different silkworms and their host plants;					X	
Determine various support systems available to strengthen sericulture; and identify the organizations involved in sericulture training and skill upgradation.		X				



**M. Sc. (Zoology) SEMESTER II**

**Elective Course-II (EC-IV)**

**ZOOLOGY PAPER ZOO MSC-S2E4 - 4CR 24 THEORY**

**Course Title: EC-IV-Food and Nutrition (Credits -4)**

<b>Course Learning Outcome</b>		
<p>At the end of this course, Students will be able to:</p> <ul style="list-style-type: none"> <li>To acquire knowledge on metabolic pathways in the human body for regulation of macro and micronutrients.</li> <li>To enrich knowledge in digestion, absorption and utilisation of nutrients.</li> <li>Gaining knowledge on nutritional bio- chemistry will enable the students to understand how the food is being utilised by our body to get energy.</li> <li>Detail knowledge on nutrition across lifespan can be obtained and different nutritional problems can be tackled easily.</li> </ul>		
<b>Module 1</b>	<b>Food groups</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b></p> <p>This module is intended to describe about nutrient and its absorption.</p> <ul style="list-style-type: none"> <li>Physiological changes and nutritional requirements.</li> </ul>		
<p><b>Learning Outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>Detail knowledge on nutrition across lifespan can be obtained and different nutritional problems can be tackled easily.</li> </ul>		
1.1	Functional food groups-energy yielding, body building and protective foods (only sources and not properties and functions). Food Pyramid, My Plate.	5L
1.2	Study of various cooking methods - Boiling, steaming, stewing, frying, baking, roasting, broiling, cooking under pressure.	5L
1.3	Cereals - composition of rice, wheat, effects of cooking on parboiled and raw rice, principles of starch cookery, gelatinization.	5L
<b>Module 2</b>	<b>Beverages</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>Nutritive value in different Beverages.</li> </ul>		
<p><b>Learning Outcome:</b></p>		



After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>Knowledge in public health nutrition will make student familiar with concept and current concern of public health nutrition &amp; its implication on the quality of life.</li> </ul>		
2.1	Classification, nutritive value, Milk based beverages- methods of preparing tea and coffee, fruit based beverages and preparation of carbonated non – alcoholic beverages.  Spices and Condiments - Uses and abuses.	5L
2.2	Fats and Oils - Types of oils, function of fats and oils, shortening effects of oil, smoking point of oil, factors affecting absorption of oil.	5L
2.3	Sugar cookery- Stages of sugar cookery, crystallization and factors affecting crystallization.	5L
<b>Module 3</b>	<b>Milk &amp; Egg</b>	<b>[15L]</b>
<b>Learning Objectives:</b>		
This module is intended to		
<ul style="list-style-type: none"> <li>Complete balance diet.</li> </ul>		
<b>Learning Outcome:</b>		
After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>Improve knowledge on advance food and nutrition will help students to plan balanced diet using food groups and help them to know new trends in food science and nutrition</li> </ul>		
3.1	Composition, nutritive value, kinds of milk, pasteurization and homogenization of milk, changes in milk during heat processing, preparation of cheese and milk powder.	7L
3.2	<b>Egg</b> - Structure, composition, classification, nutritive value, uses of egg in cookery, methods of cooking, foam formation and factors affecting foam formation.	8L
<b>Module 4</b>	<b>Protein source</b>	<b>[15L]</b>
<b>Learning Objectives:</b>		
This module is intended to		
<ul style="list-style-type: none"> <li>Different protein source and Nutritional value.</li> </ul>		
<b>Learning Outcome:</b>		
After the successful completion of the module, the learner will be able to		
<ul style="list-style-type: none"> <li>Gaining knowledge on nutritional bio- chemistry will enable the students to understand how the food is being utilised by our body to get energy.</li> </ul>		
4.1	<b>Meat</b> -Structure, composition, nutritive value, selection of meat, post mortem changes in meat, aging, tenderness,	5L



	methods of cooking meat and their effects.	
4.2	<b>Poultry</b> – types, composition, nutritive value, selection, methods of cooking.	5L
4.3	<b>Fish</b> - Structure, composition, nutritive value, selection of fish, methods of cooking and effects.	5L
<b>Zoology Practicals (Elective Paper Food and Nutrition)</b>		
<ol style="list-style-type: none"> <li>1. Food group- Grouping of foods, discussion on nutritive value.</li> <li>2. Measuring ingredients Methods of measuring different types of foods – grains, flours &amp; liquids</li> <li>3. Edible portion: Determination of edible portion percentage of different foods.</li> <li>4. Cooking methods Moist heat methods – (i) boiling, simmering, steaming, &amp; Pressure cooking, (ii). Dry heat methods – baking. (iii), Fat as a medium for Coking-shallow and deep fat frying.</li> <li>5. Prevention of darkening in fruits &amp; vegetables.</li> <li>6. Milk &amp; milk products: Common preparation with milk, cheese &amp; curd. -cheese curry &amp; cooking vegetables in milk.</li> <li>7. Flesh food: Fish, meat &amp; poultry- preparations.</li> <li>8. Egg experimental cookery- boiled egg, poached egg. Common preparations with egg.</li> <li>9. Beverages Preparation of hot beverages- coffee, tea. Preparation of cold Beverages- fruit drinks &amp; milk shake.</li> </ol>		
<p><b>Reference:</b></p> <ol style="list-style-type: none"> <li>1. Food science, Chemistry and Experimental foods by M. Swaminathan.</li> <li>2. Food Science by Norman. N.Potter.</li> <li>3. Experimental study of Foods by Griswold R.M.</li> <li>4. Food Science by Helen Charley.</li> <li>5. Foundation of Food Preparation by A.G. Peckam.</li> <li>6. Modern Cookery for teaching and trade, volume I&amp;II ,Thangam Philip. Orient Longmans Ltd.</li> <li>7. Food Fundamentals by MacWilliams, John Willy and son`s, New York.</li> <li>8. Food Facts &amp; Principles by Shakunthala manay &amp; Shadakhraswamy.</li> </ol> <p>Food Science by Srilakshmi , second edition,2002</p>		

Mapping CO\_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
To acquire knowledge on metabolic pathways in the human body for regulation of macro and micronutrients.		X				
Detail knowledge on nutrition across lifespan can be obtained and different nutritional problems can be tackled easily.		X				
To enrich knowledge in digestion, absorption and utilisation of nutrients.	X					
Gaining knowledge on nutritional bio- chemistry will enable the students to understand how the food is being utilised by our body to get energy.	X					



**M. Sc. (ZOOLOGY) SEMESTER II**  
**COURSE CODE: ZOO MSC –S2SEC 1- 2CR 24**  
**Course Title: SEC-II-Economic Entomology**  
**[Skill Enhancement Course] [CREDITS - 02]**

<b>Course Learning Outcome</b>		
<p>After the successful completion of the Course, the learner will be able to:</p> <ul style="list-style-type: none"> <li>• Define economic entomology</li> <li>• Explain pests in human habitation and habitats</li> <li>• Describe some house hold pest and its management</li> <li>• Identify pest of stored grain</li> <li>• Identify Pests of Livestock and its control</li> <li>• Know Principles and methods of pest management</li> <li>• Describe appliances for domestic pest control.</li> </ul>		
<b>Module 1</b>	<b>Economic and public health importance of insect pests</b>	<b>[15L]</b>
<p><b>Learning Objectives:</b> This module is intended to</p> <ul style="list-style-type: none"> <li>• How importance are important.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>• Define economic entomology</li> <li>• Explain pests in human habitation and habitats</li> <li>• Describe some house hold pest and its management</li> <li>• Identify pest of stored grain</li> </ul>		
1.1	<p>Economic and public health importance of insect pests in human habitation and habitats</p> <p>Biology, damage and control of mosquitoes, houseflies, bed bugs, ants, termites, cockroaches, silverfish, head and body lice.</p>	7L
1.2	<p>Stored grain pests and its management: Khapra beetle, Rice weevil, Rice moth, Pulse beetle, lesser grain borer, Indian meal moth, Saw-toothed beetle and Rodent. .</p> <p>Pests of Livestock and its control: Cattle louse, Stable fly, and sand fly. Blowfly, Black fly, Horse fly.</p>	8L
<b>Module 2</b>	<b>Pest Management</b>	<b>[15L]</b>



<b>Learning Objectives:</b>		
<ul style="list-style-type: none"> <li>Pest livestock.</li> </ul>		
2.1	Principles and methods of pest management in residential places and public buildings.	7L
2.2	Insecticides for domestic use and their safety, pre and post construction termite proofing of buildings. Appliances for domestic pest control.	8L
<b>References:</b>		
<ol style="list-style-type: none"> <li>Applied Zoology – Dr. Tarit Kumar Banerjee</li> <li>Invetebrate Zoology – E.L.Jordon</li> <li>Economic Zoology – Dr. G.S. Shukla and Dr. V.B. Upadhyay.</li> </ol>		

Mapping CO\_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Define economic entomology.	X					
Explain pests in human habitation and habitats.		X				
Describe some house hold pest and its management.		X				
Identify pest of stored grain.		X				
Identify Pests of Livestock and its control.		X				
Know Principles and methods of pest management.	X	X				



**COURSE CODE: ZOO MSC –S2PR1 - 6CR 24**

**Course Title: Experimental Zoology- I (Credits -6)**

<b>Course Learning Outcome</b>		
<p>After the successful completion of the Course, the learner will be able to:</p> <ul style="list-style-type: none"> <li>• Develop practical skills in laboratory techniques specific to zoology, including microscopy and physiological experiments.</li> <li>• Apply these skills to conduct research and analyse data.</li> </ul>		
<b>Module 1</b>	<b>(Animal physiology)</b>	<b>[3L]</b>
<p><b>Learning Objectives:</b> This module is intended to</p> <ul style="list-style-type: none"> <li>• Includes major aspect of animal physiology.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>• Acquire a deep understanding of animal physiology, including the study of organ systems, homeostasis, and physiological processes in animals.</li> <li>• Analyse how animals' function at the cellular and systemic levels.</li> </ul>		
1.1	1. Preparation of Phosphate and Bicarbonate Buffers, Physiological Mammalian Saline Solution. 2. To demonstrate the principle of Osmosis. 3. Study on oxygen consumption /salt loss or salt gain by fish. 4. Determination of GFR 5. Determination of Nitrogenous Excretory Product – Uric acid. 6. Anatomical and Physiological perspectives of mammalian circulatory system. 7. Anatomical and Physiological perspectives of mammalian Urino-genital system. 8. Physiological characteristics of Cardiac muscle, medullated and non- medullate nerves.	3L
<b>Module 2</b>	<b>Wildlife Biology and Conservation</b>	<b>[3L]</b>
<p><b>Learning Objectives:</b> This module is intended to make</p> <ul style="list-style-type: none"> <li>• Aware of wildlife biology.</li> </ul>		
<p><b>Learning Outcome:</b> After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>• Understand habitat ecology, biodiversity and importance of natural resources and</li> </ul>		



<p>their conservation.</p> <ul style="list-style-type: none"> <li>• Develop respect for nature and wildlife and understand relation between man and environment.</li> <li>• Identify different population counting techniques.</li> <li>• Interpret different capturing techniques.</li> </ul>		
2.1	<ol style="list-style-type: none"> <li>1. Biogeographic zones of India.</li> <li>2. Population Estimation by Line-transect Count</li> <li>3. Capture – Mark – Recapture (CMR) Technique</li> <li>4. To assess population growth by Population Density (D) and Relative Density (RD)</li> <li>5. Educational Field.</li> </ol>	3L
<b>Course Learning Outcome</b>		
<p>After the successful completion of the Course, the learner will be able to:</p> <ul style="list-style-type: none"> <li>• Study regeneration of certain cell and organ.</li> <li>• Basic concept of teratology.</li> </ul>		
<b>Module 3</b>	<b>Developmental Biology</b>	<b>[3L]</b>
<p><b>Learning Objectives:</b></p> <p>This module is intended to</p> <ul style="list-style-type: none"> <li>• Idea about regeneration, Teratology and Organogenesis</li> </ul>		
<p><b>Learning Outcome:</b></p> <p>After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>• In addition, students will also examine abnormal development and teratological defects to understand how and why things go wrong during development.</li> <li>• Explain and identify normal embryological anatomy and identify anomalies in development of various tissues through a comparison of normal and abnormal development.</li> </ul>		
3.1	<ol style="list-style-type: none"> <li>1. Study of slides of development of frog. Identification of Embryonic stages of frog.</li> <li>2. Study of caudal regeneration in Teleost.</li> <li>3. Fundamental relationship between structure (anatomy) and function (physiology) will be considered, so that students gain an understanding of the fundamental importance of structure that allows normal physiology.</li> <li>4. How anomalies in structure arising from abnormal</li> </ol>	3L



	<p>development adversely affect the normal functioning of a structure.</p> <p>4. Models pertaining to AR T(Assisted reproductive techniques), teratogenesis.</p> <p>4. Other exercises related to theory paper.</p>	
<b>Module 4</b>	<b>Sericulture</b>	<b>[3L]</b>
<b>Learning Objectives:</b>		
<p>This module is intended to</p> <ul style="list-style-type: none"> <li>• Teaches the students to become an entrepreneur with clear knowledge to establish Seri-farm/or silk reeler with problem solving and critical thinking attitude.</li> </ul>		
<b>Learning Outcome:</b>		
<p>After the successful completion of the module, the learner will be able to</p> <ul style="list-style-type: none"> <li>• Gain knowledge to classify and label the morphological features of different varieties of Silk.</li> <li>• Apply the knowledge of ecological requirement for cultivation and propagation of Silkworm.</li> <li>• Distinguish the intercultural activities, pruning methods and harvesting methods.</li> </ul>		
4.1	<p>1. Sericulture maps:</p> <p>a) World maps and Silk Road, b) Sericulture map of India and West Bengal</p> <p>2. Preparation of histograms and pie charts on:</p> <p>a) Production of Textile fibers in India, b) World Silk Production, c) Pie chart on mulberry and non-mulberry silk production in India</p> <p>3. Organization set up in India: (Demonstration &amp; Exercise) a) Govt. of India, b) Five traditional states viz., Karnataka, Andhra Pradesh, Tamil nadu, West Bengal and Jammu &amp; Kashmir</p> <p>4. Life Cycle of Bombyxmori:</p> <p>a) Morphology of egg, larva, pupa and adult of silkworm Bombyxmori</p> <p>5. Sex separation in larva, pupa and adult of silkworm Bombyxmori:</p> <p>6. Anatomy of Silkworm</p> <p>7. Silkworm rearing technology</p>	3L



	8. Identification of egg, larva, pupa and moths of different non-mulberry insects.	
Reference:	1. A manual Zoology Practical Zoology Chordates - Dr. P.S. Verma, S. Chand Publications 2. Practical Vertebrate Zoology By Agrawal & Jindal, Pragati Prakashan. 3. Manual of Practical Zoology Vol. I, II, III – P.K.G. Nair, Himalaya Publishing House	

Mapping CO\_PO

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
Acquire a deep understanding of animal physiology, including the study of organ systems, homeostasis, and physiological processes in animals.		X				
Analyse how animals' function at the cellular and systemic levels.					X	
Understand habitat ecology, biodiversity and importance of natural resources and their conservation.		X				
Develop respect for nature and wildlife and understand relation between man and environment.	X	X				
Identify different population counting techniques.		X				
Interpret different capturing techniques.			X			
Gain knowledge to classify and label the morphological features of different varieties of Silk.	X					
Apply the knowledge of ecological requirement for cultivation and propagation of Silkworm.			X			
Distinguish the intercultural activities, pruning methods and harvesting methods.	X					
Explain and identify normal embryological anatomy and identify anomalies in development of various tissues through a comparison of normal and abnormal development.		X				