



**Course Name : Bachelor of Science**

**Discipline : Zoology**

**(For those who joined in June 2023 and after)**

**COURSE SCHEME:**

**II year B.Sc. ZOOLOGY**

Part	Component	Subject	Hours	Credit
<b>I Semester</b>				
I	Language	Tamil	6	3
II	Language	English	4	3
III	Core	Invertebrata	6	5
III	Core	Lab - Invertebrata	2	0
III	Allied	Sericulture I	4	4
III	Allied	Lab - Sericulture I	2	0
IV	SEC 1	Ornamental Fish Farming and Management	2	2
IV	AECC 1	Communication skills for Employment – I	2	2
IV		Foundation Course - Perspectives of Zoology	2	2
<b>II Semester</b>				
I	Language	Tamil	6	3
II	Language	English	6	3
III	Core	Chordata	6	4
III	Core	Lab – Invertebrata and Chordata	2	2
III	Allied	Sericulture II	4	4
III	Allied	Lab - Sericulture I & II	2	2
IV	SBE	Animal Diversity and Adaptations	2	2
IV	NME	Human Biology	2	2



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 Virudhunagar – 626 001.

**II year B.Sc. ZOOLOGY**

Semester	Part	Subject Name	Hours	Credit	Int + Ext =Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values & Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised / New / No Change / Interchanged & Percentage of Revision
<b>III</b>	Part I	<b>Tamil</b>	6	3	25+75=100											<b>U24PT31</b>	<b>Interchange from III semester</b>
	Part II	<b>English</b>	6	3	25+75=100											<b>U24PE31</b>	<b>New</b>
	Core	<b>Cell Biology</b>	4	4	25+75=100		✓					✓	✓		✓	<b>U24ZYC31</b>	<b>Revised - 5 %</b>
	Core	<b>LAB: Cell Biology</b>	2	-	--	✓				✓	✓	✓	✓	-	✓	---	---
	Allied	<b>Sericulture III</b>	4	4	25+75=100	✓						✓		✓	✓	<b>U24ZYA31</b>	<b>New</b>
	Allied	<b>LAB: Sericulture III</b>	2	-	--											---	---
	Allied	<b>General Chemistry - I</b>	4	3	25+75=100											<b>U24CHAY31</b>	<b>New (Sem Change)</b>
	Allied	<b>LAB: Volumetric Analysis</b>	2	-	---											---	---
	SL	<b>Value Education</b>	-	3	25+75=100							✓				<b>U24VE31</b>	<b>New</b>
<b>Total</b>			<b>30</b>	<b>20</b>													
<b>IV</b>	Part I	<b>Tamil</b>	6	3	25+75=100											<b>U24PT41</b>	<b>Interchange from III semester</b>
	Part II	<b>English</b>	6	3	25+75=100											<b>U24PE41</b>	<b>New</b>
	Core	<b>Developmental Zoology</b>	4	4	25+75=100	✓						✓	✓	✓	✓	<b>U24ZYC41</b>	<b>Revised - 20%</b>
	Core	<b>LAB: Cell Biology and Developmental Zoology</b>	2	2	40+60=100	✓						✓	✓	✓	✓	<b>U24ZYCP41</b>	<b>Revised - 10%</b>
	Allied	<b>Sericulture IV</b>	4	4	25+75=100	✓						✓	✓	✓	✓	<b>U24ZYA41</b>	<b>New</b>
	Allied	<b>LAB: Sericulture III and IV</b>	2	2	40+60=100	✓						✓	✓	✓	✓	<b>U24ZYAP41</b>	<b>New</b>
	Allied	<b>General Chemistry - II</b>	4	3	25+75=100											<b>U24CHAY41</b>	<b>New (Sem Change)</b>
	Allied	<b>LAB: Volumetric Analysis</b>	2	2	40+60=100											<b>U24CHAYP41</b>	<b>New (Sem Change)</b>



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SL	Environmental Studies	-	2	25+75=100										✓					U24ES41	New
<b>Total</b>		<b>30</b>	<b>25</b>																	
<b>Internship Programme (Industrial training) during vacation</b>																				

Year	Part	Subject	Credit	Int=Total	Code
I & II	Part V	NSS/ NCC/ Physical Education – Sports/YRC/RRC	3	100=100	U22NS4 / U22NC4 / U22PS4 / U22YR4 / U22RR4



**TENTATIVE SYLLABUS STRUCTURE TABLE**

V Semester				
III	Core	Genetics and Biostatistics	5	5
III	Core	Biochemistry	5	5
III	Core	Microbiology and Immunology	5	5
III	Core	Lab - Genetics and Biostatistics	2	0
III	Core	Lab - Biochemistry	2	0
III	Core	Lab - Microbiology and Immunology	2	0
III	Allied	Chemistry III	4	4
III	Allied	Lab - Chemistry III	2	0
IV	SBE	Employability Skills	1	1
IV	SBE	Economic Zoology	2	2
VI Semester				
III	Core	Animal Physiology	5	5
III	Core	Ecology and Evolution	6	5
III	Core	Biotechnology	5	4
III	Core	Lab - Genetics and Biostatistics, and Animal Physiology	2	2
III	Core	Lab - Biochemistry, and Ecology and Evolution	2	2
III	Core	Lab - Microbiology and Immunology, and Biotechnology	2	2
III	Allied	Chemistry IV	4	4
III	Allied	Lab - Chemistry III and IV	2	2
IV	SBE	Wildlife conservation and Management/ SWAYAM	0	2
IV	SBE	Project	2	2



**SEMESTER: III**

<b>CORE: 4</b>	<b>CELL BIOLOGY</b>
<i>Contact hours per Week – 4 hours</i>	<i>Credits: 4</i>
<i>Contact hours per Semester – 60 hours</i>	<i>Subject Code: U24ZYC31</i>
<b>Course Outcomes:</b> At the end of this course, the students will be able to	
CO1: Understand the usage of Microscope to observe the minute organisms.	
CO2: Able to know the structure and functions of cell organelles.	
CO3: Imbibes the knowledge of genetic materials.	
CO4: Able to understand about protein synthesis and cell ageing.	
CO5: Understand the cell culture technique and their application.	

**UNIT – I (12 Hours)**

History of Light microscopy - Jenson's, Hooks, Leeuwenhoek and Wilson Barrell contribution - Resolving power and Magnification - Principle, components, and applications of Microscopes - Compound, Phase contrast and Scanning Electron Microscope. Microtome - Types-Sample preparation, sectioning, and staining - Application

**UNIT – II (12 Hours)**

Ultrastructure of prokaryotic and eukaryotic cell - Physical nature and biological properties of Protoplasm. Cell organelles: Structure and functions of Plasma membrane (Fluid mosaic model), Endoplasmic reticulum, Golgi complex, Mitochondria, Ribosomes, Lysosomes and centriole.

**UNIT -III (12 Hours)**

Structure and functions of Nucleus and Nucleolus – Chromosomes: Typical structure and types - Giant chromosomes: Polytene and Lamp brush - DNA and RNA – Cell cycle and cell division - Mitosis and Meiosis – synaptonemal complex

**UNIT – IV (12 Hours)**

Replication of DNA - characteristics of genetic code – Transcription and Translation in prokaryotes – Cancer: Characteristics, causes, types, and treatment - Aging: Causes, Subcellular changes during aging, programmed cell death.

**UNIT – V (12 Hours)**

History of cell culture - Laboratory requirement for culture - Composition and types of media: Natural and Artificial media - Advantages and disadvantages - Disaggregation of tissue - Establishment of cell culture - Evolution of cell lines - Maintenance of cell lines. Stem cells: Properties – Sources: Embryonic and adult stem cells – Application of stem cells.

**Text book:**

1. P. S. Verma, V. K.S. Agarwal, Text Book of Cytology, Chand & Co, New Delhi, 1999.
2. P. K. Gupta, Elements of Biotechnology, Rastogi Publications, Meerut, New Delhi, 2010.
3. S.C. Rastogi, Biotechnology Principles and Application, Narosa Publishing House,



New Delhi, 2009.

4. N. Arumugam, Cell Biology, Saras Publications, Nagercoil, 2017.
5. V. Kumaresan, Biotechnology, Saras Publication, Nagercoil, 2014.

**Reference Book:**

1. Rastogi. S.C, Cell Biology, New Age International (P) Ltd., Publisher, New Delhi, 2008.
2. P. K. Gupta, Cell Biology, Rastogi Publications, Gangotri Shivaji road, Meerut, 2017.
3. De Robertis, E.D.P. & De Robertis, Jr. E.M.F., Cell and Molecular biology, 8<sup>th</sup> Edition, Lippincott & Williams, 2001.
4. Gerald Karp., Cell biology, 6<sup>th</sup> edition, John Wiley & Sons Inc, 2010.

**e-resources:**

1. <https://youtu.be/owZL9a1e9DY>
2. [https://youtu.be/EVIKFG97\\_U](https://youtu.be/EVIKFG97_U)
3. <https://youtu.be/6qYCEysozz4>
4. <https://youtu.be/nqG9zsvd1Rk>
5. <https://youtu.be/SAVKL9OtqJ4>
6. <https://youtu.be/ApGIrUYbtK8>
7. <https://youtu.be/TMWhici4sII>
8. <https://youtu.be/pfPSSISSJfM>
9. <https://youtu.be/M10BuojsXrg>
10. <https://youtu.be/jZF4ajEtA6U>

**Questions**

1. Explain the history of light microscopy
2. Write the working mechanism of scanning electron microscope
3. Enumerate the biological properties of protoplasm
4. Explain the structure of mitochondria
5. List out the types of nucleoli
6. Give an account on mitosis
7. Summarize the steps involved in protein synthesis
8. Discuss about the types of cancer
9. Define cell culture
10. Brief about natural and artificial media

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<b>ALLIED: 3</b>	<b>SERICULTURE III</b>
<i>Contact hours per Week – 4 hours</i>	<i>Credits: 4</i>
<i>Contact hours per Semester – 60 hours</i>	<i>Subject Code: U24ZYA31</i>
<b>Course Outcomes:</b>	
At the end of this course, the students will be able to	
CO 1: Understand the requirements and preparation of a silkworm rearing house.	
CO 2: Identify the improved technologies in silkworm rearing and its impact on cocoon productivity.	
CO3: Comprehend the process of spinning and harvesting of cocoon.	



CO 4: Recognize the procedure of silkworm seed production in a grainage.

CO 5: Distinguish technologies involved in the rearing of non-mulberry silkworms.

**Unit I (12 Hours)**

Rearing house: Location, orientation, plan and utilities – CSB model rearing house – Rearing appliances: leaf chambers, chopping knife and chopping board, rearing trays, rearing stands and racks, feathers, chopsticks, net, paraffin papers, heater, blower, thermometer, humidifier, sprayer, hygrometer, rubber foam pads and ant-wells Disinfection: importance of disinfection – types of disinfectants – formalin, bleaching powder, chlorine dioxide, slaked lime and iodine compounds – methods of disinfection – hygiene practices in sericulture

**Unit II (12 Hours)**

Egg transportation – egg incubation – incubation time and devices – black boxing and its importance Multivoltine chawki rearing: brushing – methods of brushing – types of chawki rearing: traditional and improved method – optimum environmental conditions – feeding schedule – methods of bed cleaning – spacing – moulting and care during moulting Late age silkworm rearing – methods – optimum environmental conditions – feeding quantity and frequency – methods of bed cleaning – spacing – moulting and care during moulting

**Unit III (12 Hours)**

Mounting and mounting density – types of mountages – Identification of spinning larva – spinning – environmental requirements – Harvesting – time of harvesting – sorting, storage, packaging, transport and marketing of cocoons - leaf-cocoon ratio – maintenance of rearing records – byproducts of silkworm rearing and their utilization

**Unit IV (12 Hours)**

Intensive bivoltine sericulture technology package: recommended hybrids and rearing schedule – hygiene and disinfection – incubation of eggs – young age rearing – brushing – preparation of chawki bed – frequency of feeding – bed cleaning – environmental conditions for bivoltine chawki rearing – late age silkworm rearing – methods of rearing – mounting of cocoons – methods of mounting – harvesting – disinfection after rearing.

**Unit V (12 Hours)**

Organic farming in mulberry – integrated organic nutrient management practices: farmyard manure, compost, vermicompost, poultry manure, sheep and goat manure, green manures, biofertilizers, neem oil cake, pressmud, foliar fertigation, recycling and utility of seri-wastes. Effective non-chemical pest, disease and weed management practices: pest management by water jetting – biological control of pests – botanicals as insecticides – management of root rot, powdery mildew, root knot diseases by plant products – weed management by thermal weeding and black polythene mulching.

**Text book:**

1. Ganga, G., and J. Sulochana Chetty (1991), An Introduction to Sericulture, OXFORD & IBH Publishing, New Delhi.



2. Sakthivel N., Ravikumar J., Chikkanna, Mukund V. Kirsur, Bindroo B.B., Sivaprasad V., (2014), Technical Bulletin: Organic farming in mulberry: Recent breakthrough, Central Silk Board, (Ministry of Textiles – Govt. of India), BTM Layout, Madiwala, Bangalore.
3. CSR&TI, Berhampore (2015), Intensive Bivoltine Sericulture Technology Package, Central Silk Board, (Ministry of Textiles – Govt. of India), BTM Layout, Madiwala, Bangalore.
4. Krishnaswami, S., Narasimhanna, M.N.; Suryanarayan, S.K and Kumararaj, S. (1973), Sericulture Manual-2 - Silkworm Rearing. Agriculture Service Bulletin, FAO, ROME.

**Reference books:**

1. Dandin, S.B., Jayaswal, J. and Giridhar, K. (2003), Handbook of Sericulture Technologies (3<sup>rd</sup> Edn.), Central Silk Board (Ministry of Textiles – Govt. of India), BTM Layout, Madiwala, Bangalore.
2. Govindan, R., Ramakrishna Naika and Sannappa, B. (2004), Advances in Disease and Pest Management in Sericulture. Seri Scientific Publishers, Bangalore
3. Nataraju, B., Sathyaprasad, K., Manjunath, D. and Sawani Kumar, C. (2005), Silkworm Crop Protection, Central Silk Board, Bangalore.

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**SEMESTER III**

**Part III — Allied Subject — GENERAL CHEMISTRY-I for Biological Science**  
Hours per week: 4                      Subject Code: U24CHAY31  
Credits: 3

**(For those who joined from June 2024 onwards)**

**Course Outcomes:**

- CO1:** To study fundamental ideas on organic chemistry.  
**CO2:** To know the basic properties of hydrogen, hydrides & oxides  
**CO3:** To search out an idea on colloids.  
**CO4:** To learn some important petroleum processes and fertilizers  
**CO5:** To acquire a knowledge on polymers.

**Unit I: Basic concepts of organic chemistry** **12 Hours**

Organic compounds — general properties and classification of organic compounds — functional groups — homologous series. Isomerism — structural isomerism and stereoisomerism — examples — Types of organic reactions: substitution, addition and elimination with examples.

**Unit II: Hydrogen, Hydrides and Oxides** **12Hours**

**Hydrogen:**

Isotopes of hydrogen — preparation, properties and uses of heavy hydrogen — ortho and para hydrogen.

**Hydrides:**

Definition — classification of hydrides (Saline hydrides, Metallic hydrides, Molecular hydrides and Polymeric hydrides.) — Nature of hydrides and position of hydrogen in the periodic table.

**Oxides:**

Definition — classification — examples.





**Unit III: Colloids**

**12 Hours**

Colloidal state of matter — various types — classification. Sols — dialysis — electroosmosis- electrophoresis — stability of colloids — protective action — Hardy Schulze law — gold number.

Emulsion: types of emulsion — emulsifier.

Gels: Classification, preparation — application of colloids.

**Unit IV: Petroleum and fertilizers**

**12 Hours**

Refining of petroleum — composition and uses of petroleum fractions — thermal and catalytic cracking — octane number, cetane number — antiknocking agents - unleaded petroleum — petrochemicals — synthetic petrol.

Fertilizers — classification — important manures — manufacture and uses of urea — super phosphate — calcium ammonium nitrate (CAN) fertilizer.

**Unit V: Polymers**

**12 Hours**

Polymers — general characteristics — plastics — elastomers and fibres — thermoplastics and thermosetting plastics - methods of polymerization — bulk — suspension and solution polymerization. Uses of polycarbonates — polyurethanes — epoxy resins and teflons (PTFE).

**Text Books:**

**Unit I**

1. B.S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

**Unit II & III**

1. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, Villabh Publishing, 2003.

**Unit-IV & V**

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.

**Reference Books:**

**Unit I**

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.

**Unit II**

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co., Ltd., 2008.
2. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.

**Unit III**

1. P.L.Soni, Textbook of Physical Chemistry, Sultan Chand & Sons, 2008.

**Unit IV**

1. K.S.Tewari, N.K.Vishnoi and S.N.Mehrota, A Text book of Organic Chemistry, 2<sup>nd</sup> revised edition, Vikas publishing house PVT LTD, New Delhi, 2005.

**Unit V**

1. P.L.Soni, Textbook of Physical Chemistry, Sultan Chand & Sons, 2008.



**e-Resources:**

1. <https://www.priyamstudycentre.com/chemistry/organic-compound>
2. <https://youtu.be/XklMKuEAWdU>
3. <https://www.adichemistry.com/inorganic/hydrogen/H2/hydrogen.html>
4. [https://en.m.wikipedia.org/wiki/Isotopes\\_of\\_hydrogen](https://en.m.wikipedia.org/wiki/Isotopes_of_hydrogen)
5. <https://byjus.com/jee/colloids/>
6. <https://youtu.be/QAH-cCK1bS8>
7. [https://en.m.wikipedia.org/wiki/Petroleum\\_refining\\_processes](https://en.m.wikipedia.org/wiki/Petroleum_refining_processes)
8. [https://youtu.be/Dmn1X\\_z985A](https://youtu.be/Dmn1X_z985A)
9. <https://www.britannica.com/science/polymer/Synthetic-polymers>
10. <https://youtu.be/t9UtS70GR44>

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**SEMESTER: IV**

<b>CORE: 5</b>	<b>DEVELOPMENTAL ZOOLOGY</b>
<i>Contact hours per Week – 4 hours</i>	<i>Credits: 4</i>
<i>Contact hours per Semester – 60 hours</i>	<i>Subject Code: U24ZYC41</i>
<b>Course Outcomes:</b>	
At the end of this course, the students will be able to	
CO1: Understand the scope of developmental zoology, embryonic stages, anatomy of testis, spermatogenesis, Oogenesis, vitellogenesis process etc.	
CO2: Understand how a single-celled fertilized egg becomes an embryo through three important processes of cell division, cell differentiation and morphogenesis. Fate map useful to see the developmental stages of the organism.	
CO 3: Identify the embryonic development of different vertebrate organisms through germinal layers, followed by without mating the young one are produced through the parthenogenesis and their significance.	
CO4: Understand the placentation in various mammals and teratogenic effects during the embryonic developmental stages formation.	
CO5: Know the metamorphosis and hormonal changes during the entire regeneration process.	

**UNIT – I (12 Hours)**

Definition and Scope of Developmental Zoology – Gametogenesis: Spermatogenesis - morphological diversity of sperm – Structure of mammalian sperm – Oogenesis – Vitellogenesis – Process and significance – Types of Eggs and Egg membranes – Polarity and symmetry

**UNIT –II (12 Hours)**

Fertilization – Definition – Process and Significance. Entry of sperm – egg activation, Post fertilization changes – block to polyspermy – Theories of fertilization – Planes and patterns of cleavage – Factors affecting cleavage – Cleavage in frog, chick and mammals – Morula and Blastulation – Morphogenetic movements in frog – Fate maps

**UNIT – III (12 Hours)**

Gastrulation in frog, chick and mammal – Development of ectodermal, mesodermal and endodermal derivatives – development of brain, eye, kidney and heart in frog.  
Parthenogenesis: Definition, significance and types



**UNIT –IV**

**(12 Hours)**

Foetal membranes in birds and mammals – Placentation in mammals – Teratogenesis: Teratogenic agents and their effects on embryonic development; Biochemical gradient in Sea Urchin Eggs. Factors affecting gradients.

**UNIT – V**

**(12 Hours)**

Amphibian metamorphosis – types – Regressive and Progressive Metamorphosis – hormonal control – Organizer – Regeneration – nuclear transplantation – Gradient theory – induced ovulation – Artificial insemination – IVF – Embryo transfer

**Text books:**

1. Verma, P.S and Agarwal, V.K. S. Chordate Embryology: Developmental Biology, Chand & Company Ltd., New Delhi. 2014.
2. N. Arumugam, Textbook of Embryology, Saras Publication, Nagercoil. 2017.

**Reference Books:**

1. Balinsky, B.I. (1981) An introduction to Embryology, 5 th Edition. W.B. Saunders Co. London.
2. Patten (1971.) Fundamentals of Embryology — McGraw Hill Book Co. New York.
3. Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc.

**e- Resources:**

1. <https://www.youtube.com/watch?v=EwTZ1fypivg>
2. [https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004080636590834shailie\\_Cleavage\\_and\\_Types.pdf](https://www.lkouniv.ac.in/site/writereaddata/siteContent/202004080636590834shailie_Cleavage_and_Types.pdf)
3. <https://gcwgandhinagar.com/econtent/document/15880664725.4%20Gastrulation%20in%20Frog%20upto%20the%20formation%20of%20three%20germ%20layers%20%20n%20Types%20of%20Morphogenetic%20moments%20Unit%20V.pdf>
4. <https://dducollegedu.ac.in/Datafiles/cms/ecourse%20content/FATE%20MAPS%2026.03.2020%20dev%20bio.pdf>
5. [https://jrc.ac.in/working\\_folder/DOWNLOAD-D-11-46-5E12E2036906F.pdf](https://jrc.ac.in/working_folder/DOWNLOAD-D-11-46-5E12E2036906F.pdf)
6. <https://gacbe.ac.in/pdf/ematerial/18BZO51C-U3.pdf>
7. <https://elearning.raghunathpurcollege.ac.in/files/A1AF192A15859944500.pdf>

**Questions**

1. Describe the process of Gametogenesis with a neat diagram.
2. Specify the Structure of mammalian sperm with a diagram.
3. Write the types of eggs and egg membrane.
4. Mention the process of block to polyspermy
5. Enumerate the process of Parthenogenesis
6. List out the Planes and patterns of cleavage with neat diagram
7. What are the Factors affecting the cleavage process?
8. Write a detailed account on Morphogenetic movements in frog
9. Explain the Fate maps of the chick with diagrams.
10. Specify the mechanism of In vitro fertilization process
11. Describe the Metamorphosis and their types



<b>CORE: 6</b>	<b>LAB: CELL BIOLOGY AND DEVELOPMENTAL ZOOLOGY</b>
<i>Contact hours per Week – 2+2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 60 hours</i>	<i>Subject Code: U24ZYCP41</i>
<b>Course Outcomes:</b> At the end of this course, the students will be able to	
CO1: Student able to handle the Microscope	
CO2: Acquires the knowledge of anatomy of the organisms	
CO3: Expertise in analysing the developmental stages of Chick Embryo	
CO4: Understand the mounting of Human epithelial cells	

### CELL BIOLOGY

1. Microscopy - Dissection microscope, Compound Microscope
2. Mounting of Squamous epithelial cell
3. Identification of different epithelial cells using permanent slides
4. Chironomus larva - Mounting of Salivary gland Chromosomes
5. Observation of mitotic stages in onion root tip
6. Observation of meiotic stages using permanent slides
7. Microtome
8. Preparation of histological slide (Demonstration)
9. Study of cell organelles using models/ charts: Endoplasmic reticulum, Ribosomes, Mitochondria, Golgi complex, Nucleus, DNA, tRNA
10. Sketching of cells using Camera lucida

### DEVELOPMENTAL ZOOLOGY

1. Spermatogenesis – Cross section of testis (Rat/Squirrel)
2. Observation of motility of bull sperm
3. Human sperm smear (Slide) enlarged Human sperm(diagram)
4. Oogenesis – Cross section of mammalian ovary (Permanent slide/ Chart)  
Frog embryology study of developmental stages of frog- Egg, cleavage, vertical section of blastula- vertical section of gastrula (permanent slides/chart)- observation of frog egg. Neurula (Diagram)
5. Temporary chick blastoderm mounting
6. Identification of developmental stages of chick -24 Hours,48 Hours,72 Hours and 96 Hours.
7. Development of Eye in chick - Transverse section through Eye (permanent slide)
8. Placenta – Cotyledonary and Discoidal placenta (Museum specimens/ chart/ model)
9. Observation of Developmental stages of mosquito larvae
10. Observation of developmental stages of Drosophila



<b>ALLIED: 4</b>	<b>SERICULTURE IV</b>
<i>Contact hours per Week – 4 hours</i>	<i>Credits: 4</i>
<i>Contact hours per Semester – 60 hours</i>	<i>Subject Code: U24ZYA41</i>
<b>Course Outcomes:</b> At the end of this course, the students will be able to	
CO1: introduce the concept of cocoon, quality of cocoon and marketing of cocoon.	
CO2: know the pre-cocoon operation for reeling and its significance in reeling technology.	
CO3: acquaint with the technologies of silk reeling and importance in reeling devices.	
CO4: understand the properties and uses of silk, significance of processing and testing of raw silk.	
CO5: know the economics of silkworm rearing and Entrepreneurship development programme.	

### Unit I

Evolution of silk reeling industry and its present status – reeling as a cottage Industry – scope and limitation – importance of quality cocoons – Physical and commercial characteristics of cocoons: cocoon colour, shape, size, hardness, grain/wrinkle, weight of cocoon, weight of cocoon shell and shell ratio – Cocoon sorting: objectives and procedure – defective cocoons: double, flimsy, melted, urinated, stained, uzi-infested, moth emerged, deformed and flossy – Cocoon marketing: procedure for procurement of raw material – purchase of cocoon in open auction – grading of cocoons – visual inspection and selection – price fixation

### Unit II

Cocoon Stifling methods: sun-drying, steam stifling, hot air drying, Yamato hot air driers – advantages and disadvantages – preservation of cocoons – Cocoon cooking methods: open pan, three-pan, pressurized, floating and sunken systems – merits and demerits – Cocoon brushing methods: stick, hand and mechanical brushing – Reeling water: Use of water in silk reeling – water quality – relationship between water quality and silk reeling – corrective measures

### Unit III

Objective of silk reeling – Reeling operations: Formation of reeling end, jettebout, croissure, reels, speed of reels, traverse or distributors – Re-reeling and packing: Objectives, grant reeling, hank preparation, lacing, skeining, booking, bale making and bundling Reeling units: Country charkha, cottage basin, multi-end reeling machine, auto and semi-automatic reeling machines and improved CSRTI reeling devices – advantages and disadvantages

### Unit IV

Raw silk properties of Mulberry, Tasar, Eri and Muga silk: physical, chemical and microscopic – factors influencing the properties of raw silk – Raw silk testing: conditioned



weight, visual inspection and mechanical tests: winding test, size deviation test, seriplane test, serigraph test and cohesion test – Raw silk grading: International standards (ISA) and Bureau of Indian Standards (BIS) Silk throwing and twisting: objectives of throwing – preparation for twisting, twisting of yarn, soaking, dressing, drying, winding, doubling and twisting – Silk weaving: warping, beaming, drawing denting, weft preparation, power loom and handloom weaving – Chemical processing of silk yarns and fabrics: Degumming, bleaching, dyeing, printing of silk yarns and fabrics – Byproducts of silk reeling industry and their utilization

### Unit V

Entrepreneurship development programme (EDP): Emergence and objectives of EDP – essential qualities to become an entrepreneur – selection of a potential entrepreneur – EDP in raising mulberry saplings, organization of chawki rearing centres, silk reeling units and mass production of parasitoids and predators – Mulberry cultivation (per hectare) – Cost and returns under irrigation and rain fed condition – Economics of silkworm rearing: Investment and returns

#### Text book:

1. Ganga, G., and J. Sulochana Chetty (1991) An Introduction to Sericulture, OXFORD & IBH Publishing, New Delhi.

#### Reference books:

1. Jolly. M.S. Chowdhuty. S.N and Sen (1975) Non-Mulberry Sericulture in India, Central Silk Board, Bangalore.
2. Ullal S.M. and Narasimhanna M.N. (1987) Handbook of Practical Sericulture, Central Silk Board, Bangalore.
3. Mahadeveppa, D., Halliyal, V.G., Shankar, A.G. and Bhandiwad, R. (2000) Mulberry Silk Reeling Technology, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
4. Yong Woo Lee (1999) Silk Reeling and Testing Manual, FAO Agricultural Services Bulletin, No. 136, Rome, Italy.
5. Khanka S.S. (2007) Entrepreneurial Development, S. Chand Publishing Co, New Delhi.

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<b>ALLIED: 5</b>	<b>LAB: SERICULTURE III &amp; IV</b>
<i>Contact hours per Week – 2 hours</i>	<i>Credits: 2</i>
<i>Contact hours per Semester – 30 hours</i>	<i>Subject Code: U24ZYAP41</i>
<b>Course Outcomes:</b>	
At the end of this course, the students will be able to	
CO1: rear the silkworm in optimal environmental conditions	
CO2: sort the silk cocoons based on various criteria.	
CO3: perform mother moth examination to ascertain pebrine disease.	
CO4: estimate the sericin and fibroin contents in the silk fibre.	





CO5: determine the characteristics of commercial cocoons.

### **SERICULTURE III**

1. Model and layout of silkworm rearing house with a rearing capacity of 100 DFLs
2. Silkworm rearing equipments and their uses
3. Effective concentration of disinfectants and preparation of disinfectants – disinfection of rearing houses and equipments
4. Methods of brushing of silkworms
5. Young-age silkworm rearing – methods and operations
6. Late-age silkworm rearing – methods and operations
7. Mounting – mountages, identification and mounting of spinning larvae
8. Plan of model grainage building and grainage equipments
9. Processing of seed cocoons – deflossing – sorting – selection of good cocoons – assessment of seed cocoons – pupal examination
10. Mother moth examination – individual and mass – whole and sampling methods – surface sterilization of silkworm eggs
11. Study of Meiosis in testis of Silk moth
12. Rearing of non-mulberry silkworm

### **SERICULTURE IV**

1. Preparation of line graph/ bar chart on trend of silk yarn and other textile fibre production over a period of 10 years
2. Determination of good cocoon and defective cocoon percentage
3. Determination of commercial characters of cocoon: average cocoon weight, shell weight, shell percentage or shell ratio, average filament length, reelability, raw silk recovery percentage, renditta and denier
4. Different methods of cocoon stifling (Photographs/ ICT tools)
5. Methods of cocoon boiling
6. Reeling units: Epprouvette, Charaka, Cottage basin, Multi-end and Automatic reeling devices (Photographs/ ICT tools/ Field visit)
7. Identification of textile fibers by physical and chemical test, microscopic examinations, flame tests and solubility test for polyester, cotton and silk
8. Estimation of sericin and fibroin percentage
9. Study of different types of silk wastes
10. Preparation of a project detailing cost and economics in sericulture
11. Visit to the silkworm (chawki/ late age) rearing houses, grainage centre, cocoon markets and/ or silk reeling establishments and/ or silk fabric manufacturing unit and/ or museum of Extension Division of CSRTI, Mysore must be undertaken to expose the students various aspects of post cocoon technology. The students should submit a consolidated report on such visits individually in handwritten mode at the end of the course and it should be assessed externally.



**SEMESTER IV**

**Part III — Allied subject II — GENERAL CHEMISTRY —II for Biological science**

**Hours per week: 4**

**Credits: 3**

**Subject Code: U24CHAY41**

**Course Outcome:**

**CO1:** To study the separation of chemicals by chromatography techniques.

**CO2:** To know the classification of proteins, structure and function of nucleic acids and

Hormones, and the basics of vitamins

**CO3:** To learn the basics of chemical calculation

**CO4:** To acquire a knowledge on detection and estimation of elements

**CO5:** To gain adequate knowledge on dyes

**Unit I: Chromatography**

**12 Hours**

Basic principles of common types of chromatography — Paper chromatography — thin layer chromatography — column chromatography — Ion exchange chromatography. Applications of each technique.

**Unit II: Protein, Nucleic acids, Hormones and vitamins**

**12 Hours**

Definition — classification of proteins — colour reaction of proteins — Nucleic acids — nucleoside — nucleotides and general structure of DNA. Hormones — classification — structure of some sex hormones — oestrone and testosterone. Vitamins — classification of vitamins — sources and deficiencies of Vitamins A, B1, C, D, E and K (structural elucidation not required).

**Unit III: Basic chemical calculation**

**12 Hours**

Significant numbers — SI Units— calculation of formula weight—understanding Avogadro number — mole concept — mole fraction of the solvent and solute — conversion of grams into moles and moles into grams — stoichiometric equations.

Methods of expressing concentration of the solution: normality, molarity and molality — calculations based on principle of volumetric analysis.

**Unit IV: Detection and estimation of elements**

**12 hours**

Detection of nitrogen, halogens and sulphur (Lassaigne's test) — estimation of carbon and hydrogen (Liebig's method), sulphur and halogens (Carius method) — Determination of empirical and molecular formula — structural formula.

**Unit V: Dyes**

**12 Hours**

Dyes - colour and constitutions — chromophore - auxochrome theory - classification of dyes by structure and methods of applications - preparation of methyl red, Bismarck brown, Malachite green, Indigo and Congo red.

**Text Books:**

**Unit – I**

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

**Unit – II**

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co.,2011.

**Unit – III**

1. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.

**Unit – IV**

1. P.L.Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 2008.





**Unit – V**

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011
2. B.S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

**Reference Books:**

**Unit - I**

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

**Unit - II**

1. P.L.Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 2008.

**Unit - III**

1. K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, textbook of organic Chemistry, Vikas house PVT Ltd, New Delhi, 1998.

**Unit - IV**

1. B.S.Bahl and Arun Bah1, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

**Unit - V**

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co., Ltd., 2008.

**e-Resourses:**

1. <https://microbenotes.com/chromatography-principle-types-and-applications/>
  2. <https://youtu.be/8m7CeObsTIk>
  3. <https://youtu.be/AUMJwjLXh1M>
  4. <https://simple.m.wikipedia.org/wiki/Vitamin>
  5. [https://en.m.wikipedia.org/wiki/Significant\\_figures](https://en.m.wikipedia.org/wiki/Significant_figures)
  6. <https://chemistryonline.guru/normality-molarity-molality-3/>
  7. [https://youtu.be/aH-Cjyn8V\\_Y](https://youtu.be/aH-Cjyn8V_Y)
  8. <https://www.adichemistry.com/organic/basics/analysis/lassaignes/lassaignes-test.html>
  9. <https://youtu.be/MhBEj32wZqE>
  10. <https://www.britannica.com/technology/dye>
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**Part III — Allied Chemistry Lab I — LAB: VOLUMETRIC ANALYSIS**

**Hours per week: 2      Subject Code: U24CHAYP41      Credits: 2**

**Course Outcome:**

**CO1:** To acquire the basic principles of volumetric titration,

**CO2:** To understand the basic knowledge on standard solution, molar and the indicator

**CO3:** To get the knowledge on the titration between acidimetry and alkalimetry

**CO4:** To develop the basic knowledge on permanganometry



**CO5:** To know the fundamental knowledge on iodometry.

**(Exam to be conducted at the end of even Semester)**

A double titration involving making up of the solution to be estimated or single titration involving making up of the solution to be estimated and the preparation of standard solution.

**(a) Acidimetry and alkalimetry**

1. Titration between a strong acid and strong base.
2. Titration between a strong acid and weak base.
3. Titration between a weak acid and strong base.

**(b) Permanganometry**

1. Titrations between potassium permanganate and oxalic acid, ferrous sulphate and ferrous ammonium sulphate.

**(c) Iodometry**

1. Titrations between sodium thiosulphate with potassium permanganate and potassium dichromate (demonstration only)
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