Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil University, Satara

Lead College, Yashavantrao Chavan Institute of Science, Satara,
(An Autonomous)

Syllabus

B.Sc. Honors Zoology

Syllabus to be implemented from June 2023

NEP 2020

Syllabus for B.Sc. I (Zoology)

Preamble:

1) To impart 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 the 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 an 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 society.
9) In Autonomous the addition of more syllabi 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 the betterment of society.
11) To inspire students to reach the frontiers of life sciences through commitment, hard work, study and research.

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.

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.

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.

Program Specific Outcomes:

1. Understand the basics of Zoology.

2. Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.

3. Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Zoology.

4. Identify their area of interest in academic, research and development.

5. Perform job in various fields' like science, environment, education, banking, business and public service, etc. or be an entrepreneur with precision, analytical mind, innovative thinking, clarity of thought, expression, and systematic approach.

1. **Title:** Zoology

2. **Year of Implementation:** The syllabus will be implemented from June, 2023 onwards.

3. Duration: The course shall be a full time.

4. Pattern: Semester examination.

5. Medium of Instruction: English.

6. Structure of Course:

Level 4.5, Semester I

	Course Title	**Theory**			**Practical**		
		Course Code	Credits	Lectures Per Week	Course Code	Credits	Lectures Per Week
Major Papers	Animal Diversity I	BZT 111	2	4	BZP 113	4	4
	Physiology	BZT 112	2				
Minor Papers	Amazing Invertebrate	BZT 114	2	4	BZP 116	4	
	Ethology	BZT 115	2				
OE/ GE	Basics in apiculture	BZT 117	2	4	BZP 119	2	
	Techniques in Bee Keeping	BZT 118	2				
SEC	---	--	--	--	--	--	--
IKS	Basics in Ayurveda	BZT 101	2	2	--	--	--
VEC	Digital Education	VEC 104	2	2	--	--	--

Level 4.5, Semester II

	Course Title	Theory			Practical		
		Course Code	Credits	Lectures Per Week	Course Code	Credits	Lectures Per Week
Major Papers	Cell Biology and Evolutionary Biology	BZT 121	2	4	BZP 123	2	4
	Genetics	BZT 122	2				
Minor Papers	Zoogeography and Ethology	BZT 124	2	4	BZP 126	2	4
	Biodiversity Conservation	BZT 125	2				
OE/ GE	Bee Keeping and Management	BZT 127	2	4	BZP 129	2	2
	Marketing Management	BZT 128	2				
SEC	Cocoon Handicraft Technician	SEC 103	1	2	--	1	2
IKS	--	--	--	--	--	--	--
VEC	--	--	--	--	--	--	--

OE= Open Elective
SEC: Skill Enhancement Course
IKS: Indian Knowledge System
VEC: Value Education Course

Level 4.5, Semester-I

BZT: 111: Course I - ANIMAL DIVERSITY – I (Credits: 02)

Course Objectives: Students should be able to…

1. Learn the animal classification.
2. Understand the canal system in Sycon.
3. Acquired knowledge about types of corals and parasitic adaptations of Tapeworm and Ascaris.
4. Identify the species in pearl culture and species of earthworm used for vermicomposting

Total Credits: 2 UNIT No.	**Semester – I BZT111: Course I - ANIMAL DIVERSITY – I**	**No. of hours per unit**
UNIT I	**Kingdom – Protista**	06
	❖ 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*	
UNIT II	**Phylum – Cnidaria**	08
	❖ General characters and classification up to classes ❖ Importance and types of corals.	
	Phylum – Platyhelminthes	
	❖ General characters and classification up to classes ❖ Life history of *Taenia solium* and its parasitic Adaptations.	
UNIT III	❖ **Phylum – Nemathelminths**	08
	❖ General characters and classification up to classes ❖ Life history of *Ascaris lumbricoides* and its parasitic adaptations.	
	❖ **Phylum – Arthropoda**	
	❖ General characters and classification up to classes ❖ vision in Arthropoda ❖ Metamorphosis in insects.	
UNIT IV	**Phylum – Annelida**	**08**
	❖ General characters and classification up to classes ❖ Species of Earthworm used for Vermicomposting ❖ Preparation of vermicompost bed.	
	Phylum– Mollusca	
	❖ General characters and classification up to classes ❖ Scope in Pearl culture ❖ Species in pearl culture	
	Phylum– Echinodermata	
	❖ General characters and classification up to classes ❖ Water vascular system in Asteroidea	
	Total Contact Hours	**30**

Course Outcomes: Students will be able to…

1. Differentiate 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 in pearl culture and the species of earthworm used for vermicomposting

Reference Books:

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

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BZT 112: Course II - PHYSIOLOGY

Course Objectives: Students should be able to….

1. Learn the digestion and absorption in the alimentary canal in humans.
2. Understand the mechanism of pulmonary ventilation and urine formation.
3. Acquire special assessment techniques which may be used in the physical examination of the cardiovascular system, including blood pressure and electrocardiogram (ECG).
4. Compare the reproductive physiology of males and females.

Total Credits: 02 **Unit No.**	**BZT112: Course II – PHYSIOLOGY**	**No. of hours per unit**
UNIT I	**Digestion**	06
	❖ Physiology of digestion in the alimentary canal. ❖ Absorption of carbohydrates, proteins, lipids.	
UNIT II	**Respiration**	08
	❖ Pulmonary ventilation ❖ Transport of oxygen and carbon dioxide in blood	
	Excretion	
	❖ Structure of nephron ❖ Mechanism of urine formation, Counter – current Mechanism	
UNIT III	**Cardiovascular system**	08
	❖ Composition of blood ❖ Structure of heart ❖ Origin and conduction of the cardiac impulse ❖ Cardiac cycle	
	❖ **Blood Pressure**	
	❖ Measurement of systolic & diastolic pressure ❖ cardiac output	
	❖ **ECG measurement**	
	❖ Physiological measurement & significance	

UNIT NO.	BZT112: Course II – PHYSIOLOGY	No. of hours per unit
UNIT IV	**Reproductive Physiology** ❖ Reproduction and Endocrine glands: Physiology of Male reproduction: Hormonal control of spermatogenesis. ❖ Physiology of female reproduction: Hormonal control of menstrual cycle.	08
	Total Contact Hours	**30**

Course Outcomes: Students should be able to….

1. Explain 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.

Reference Books:

1. A. P. Krishna, *Fundamentals of Medical Physiology*, Ist Edition (Innovative Publisher, 2021) Pages 596.
2. Harvey Pough, *Vertebrate life* , VIII Edition, (Pearson International,2012) Pages 720.
3. Arthur Guyton, and John Hall, *Textbook of Medical Physiology*, XII Edition, (Harcourt Asia Pvt .Ltd /W.B. Saunders Company, 2011) Pages1112.
4. Gerard Tortora, and Bryan Derrickson, *Principles of Anatomy and Physiology*, XI Edition , (John Wiley & Sons , Inc., 2009).
5. Brian Hall and Bendedikt Hallgrimsson. *Strickberger's Evolution*, IV Edition, (Jones and Barlett publishers Inc., 2008) Pages 760.
6. Eric Widmaier, Hershel Raff and Kevin Strang, *Vander's Human Physiology*, XI Edition, (Boston: McGraw Hill Higher Education, 2008) Pages 770.
7. John Young, *The Life of Vertebrates*, III Edition. (Oxford university press, 2004)
8.

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Practical: BZP103 **Practical I**

Course Objectives: Students should be able to….

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

Total Credits = 2 PRACTICAL No.	**Practical:** BZP113 **Practical I** **(Practical Based on Course BZT 111 Animal Diversity – I and BZT 112: Physiology)**	**Total No. of hours 60**
1	Study of *Amoeba, Euglena, Plasmodium, Paramoecium,* w.r.t. classification and locomotion.	
2	Study of the following Phylum w.r.t Classification and morphological peculiarities: Study of Sycon, *Hyalonema* and *Euplectella*, Obelia, *,Physalia ,Aurelia ,Tubipora, Metridium ,*	
3	❖ **Phylum: Platyhelminthes** ❖ *Taenia solium ,* Male and female ❖ **Phylum: Nemathelmithes** ❖ *Ascaris lumbricoides* ❖ **Phylum: Annelida** ❖ *Aphrodite* ❖ *Nereis* ❖ *Pheretima* ❖ *Hirudinaria*	
4	❖ **Phylum:Arthropoda** ❖ *Palaemon* ❖ *Cancer* ❖ *Limulus* ❖ *Palamnaeus* ❖ *Scolopendra* ❖ *Julus* ❖ *Periplaneta*	

	❖ *Apis*
5	❖ **Phylum: Mollusca** ❖ *Chiton* ❖ *Dentalium* ❖ *Pila* ❖ *Unio* ❖ *Loligo* ❖ Sepia ❖ Octopus
6	❖ **Phylum: Echinodermata** ❖ *Pentaceros* ❖ *Ophiura* ❖ *Echinus* ❖ *Cucumaria* ❖ *Antedon*
7	**1. Study of the following:** i. T.S. and L.S. of Sycon, ii. Life history *Taenia* and *Ascaris* and their parasitic adaptations.
8	Demonstration/ Preparations of hemin and hemochromogen crystals.
9	Measurement of Blood Pressure by Sphygmomanometer.
10	Recording of ECG.
11	Study of Earthworm species used for Vermicomposting
12	Study of types of corals
13	Study of species in pearl culture
14	Identification eye structure of arthropod under Scanning Electron Microscope (SEM)
15	Study Tour: Visit to Natural History Museum and submission of report./ Visit to sea shore/ Visit to any suitable place to study animal diversity.

Course Outcomes: Students will be able to…

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

Level 4.5, Semester I

Minor Subject: Zoology

Course I BZT 114: AMAZING INVERTEBRATES (Credits: 02)

Course Objectives: Students will be able to…

1. Understand the Mechanism of bioluminescence
2. Define the Parental care
3. Distinguish courtship of behavior
4. Analyze the defense mechanism in invertebrates

Total Credits: 2 **UNIT No.**	**Course I - AMAZING INVERTEBRATES**	**No. of hours per unit**
UNIT I	**Bioluminescence in Invertebrates**	8
	❖ Introduction of bioluminescence ❖ Mechanism of bioluminescence ❖ Examples of bioluminescence ❖ Fire fly ❖ Jelly fish ❖ star fish ❖ octopus ❖ Shrimps	
UNIT II	**Parental Care in Invertebrates**	8
	❖ Introduction of Parental care ❖ Types of Parental care ❖ Male giant water bug ❖ Mud wasp ❖ Scorpion	
UNIT III	**Courtship behaviour in Invertebrates**	8
	❖ Natural Selection and reproductive behavior ❖ External and Internal Influences ❖ Modes of Sexual Attraction ❖ Paramecium ❖ Butterfly ❖ Damesl fly	

	❖ Sepia ❖ Nursery web spider	
UNIT IV	**Defence Mechanism in Invertebrates**	6
	❖ Sepia ❖ Stick insect ❖ Boxer crab ❖ Bombardier beetle ❖ Malaysian Ant ❖ Sea cucumber	
	Total Contact Hours	**30**

Course Outcomes: Students should be able to…

1. Recognize the mechanism of bioluminescence
2. Compare Parental care
3. Classify courtship of behavior
4. Distinguish the defense mechanism in invertebrates

Reference Books:

1. Edward Ruppert and Robert Barnes, *Invertebrate Zoology*, VIII Edition. (Thomson Press: India, 2006) Pages 998.
2. Dhami. Invertebrate Zoology 10th Edition.(New Delhi, R. Chand & Company, 2003)
3. R.L. Kotpal. Modern Text Book of Zoology: Invertebrate 10thEdition. (Rastogi Publications, New Delhi, 2003).
4. Robert Barnes, Peter Calow, Olive, P.J.W., Golding, D. W. and Spicer , J.I. *The Invertebrates*: A New Synthesis, III Edition, (Oxford, Wiley Blackwell Science, 2002) Pages:512.

Course II: BZT 115 ETHOLOGY (Credits: 02)

Course Objectives: Students should be able to…

1. Know the causes and method of behavior
2. Understand the communication behavior in animals
3. Distinguish patterns of behavior
4. Evaluate the biological rhythym

Total Credits: 2 **UNIT No.**	**Course I – ETHOLOGY**	**No. of hours per unit**
UNIT I	**Introduction to Ethology**	06
	Origin and history of Ethology, Proximate and ultimate causes of behaviour, Methods and recording of behaviour	
UNIT II	**Social organization and Communication in Animals**	08
	❖ Aggregations - Schooling in fishes, flocking in birds, herding in mammals; group selection, kin selection, altruism, inclusive fitness Social organization in Honey bee and Termites	
	Communication in animals: Visual, olfactory, auditory and tactile	
	Nesting behaviour in Weaver bird	
UNIT III	**Concepts and Patterns of behaviour**	08
	❖ Types of behaviour:- Innate/ Instinct behavior, Acquired/ Learned Behavior ❖ Patterns of Behavior: Taxes, Reflexes, Orientation, Instinct, Habituation, Imprinting & Motivation	
	Ecological Aspects of Behaviour: Habitat selection, food selection and optimal foraging theory, anti-predator defense mechanisms, aggression, territoriality and dispersal. Camouflage and Mimicry - types of mimicry	
UNIT IV	**Biological rhythms:**	08
	Circadian, circannual, tidal/lunar, ultradian, infradian rhythms, synchronization of biological rhythms, phase shift. Photoperiodism with reference to birds and mammals - human circadian rhythms.	
	Total Contact Hours	**30**

Course Outcomes: Students will be able to…

1. Identify the causes and method of behavior
2. Classify the communication behavior in animals
3. Illustrate patterns of behavior
4. Differentiate the biological rhythym

Reference Books:

1. David McFarland, Animal Behaviour, Pitman Publishing Limited, London, UK.
2. Manning, A. and Dawkins, M. S, An Introduction to Animal Behaviour, Cambridge, University Press, UK.
3. John Alcock, Animal Behaviour, Sinauer Associate Inc., USA.
4. Paul W. Sherman and John Alcock, Exploring Animal Behaviour, Sinauer Associate Inc., Massachusetts, USA.
5. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing.

BZP 116: Practical Based on Course I and II

Course Objective: Students should be able to…

1. Learn the nesting habitat of invertebrate
2. Understand the communication behaviour and types of mimicry.
3. Gain the knowledge about types of parental care and courtship behaviour in invertebrates.
4. Evaluate the ecological aspects of behaviour

Total Credits: 2 Practical No.	**Practical Course Based on Course I and II (Practical Based on BZT 114 and BZT 115)**	**No. of hours per unit**
1	Study of nests and nesting habitats of weaver bird	4
2	Study of nest and nesting habitat of Social insect	4
3	Study of circadian functions in humans (daily eating, sleep and temperature patterns).	4
4	Study of Phototaxis behaviour in insect larvae	4
5	Study of communication behaviour in honey bee	4
6	To study the types of mimicry	4
7	Study of mechanism of bioluminescence in invertebrates	4
8	Study of Camouflage	4
9	Study of courtship behaviour in invertebrates	4
10	Study of types of Parental care	4
11	Study of defence mechanism in Boxer crab	4
12	Study of ecological aspects of behaviour w.r.t Habitat selection and Natural selection	4
13	Study of defence mechanism in stick insect	4
14	Case Study of Animal Behaviour	4
15	Field Visit	4
	Total Contact Hours	**60**

Course Outcomes: Students will be able to…

1. Classify the nesting habitat of invertebrate
2. Interpret the communication behaviour and types of mimicry.
3. Summarize the types of parental care and courtship behaviour in invertebrates.
4. Determine the ecological aspects of behaviour

Department of Zoology and Fisheries

Open Elective Course (Other Stream): Apiculture

Level 4.5, Semester I

Course I: BZT 117:- Basics in Apiculture

Course Objective: Student should be able to…

1. Learn the traditional and modern bee keeping
2. Know the types of honey bee and species of honey bee
3. Identify queen, drone and worker of honey bee
4. Acquire the knowledge about value added products of honey

Total Credits: 02 Unit No.	**Course I: Basics in Apiculture**	**No. of hours per unit**
Unit I	**Introduction to Apiculture:** ❖ Scope and importance ❖ History of bee keeping: Definition, Bee keeping in worldwide ❖ Traditional bee keeping, Modern beekeeping, Urban or backyard beekeeping. ❖ Apiculture development in India - institutions involved. ❖ Role of Central Honey Bee Research & Training Institute.	**08**
Unit II	**Honey Bee morphology:** ❖ Honey bee species and identification ❖ Origin, systematic and distribution of honey bees. ❖ Types of honey bees, Species of honey bees. Bee identification. ❖ Morphology of Honey Bee: Head & Abdomen, wax glands, sting apparatus, scent gland.	**08**
Unit III	**Social behavior:** ❖ Social Organization: Colony life and social organization – Queen, drone, worker. ❖ Communication in Bees.	**06**
Unit IV	**Honey - its properties and application in various fields:** ❖ Honey - its medicinal properties - application in various fields - other valuable by products of honey bees. ❖ Value added honey products.	**08**

	❖ Properties of honey products, Nutrients and composition of honey, Acid content and flavor effects. ❖ Types of value added honey products	

Course Outcomes: Student will be able to

1. Classify the traditional and modern bee keeping
2. Differentiate the types of honey bee and species of honey bee
3. Recognize queen, drone and worker of honey bee
4. Apply the knowledge about value added products of honey

Reference Books:

1. Ted Hooper, 2010. Guide to Bees and Honey: The World's Best Selling Guide to Beekeeping. Northern Bee Books. Oxford.
2. David Cramp, 2012. The Complete Step-by-step Book of Beekeeping: A Practical Guide to Beekeeping, from Setting Up a Colony to Hive Management and Harvesting the Honey. Lorenz Books. London.
3. Craig Hughes, 2010. Urban Beekeeping: A Guide to Keeping Bees in the City. e Good Life Press, Preston.
4. Ted Hooper, By (author) Clive De Bruyn, By (author) Margaret Thomas, 2014. The Beginner's Bee Book. Stenlake Publishing, Ayrshire.
5. Laidlaw, H.H., 1997. Contemporary queen rearing. Published by Dadant and Sons. R. A. Morse, Rearing queen honey bees. Wicwas press, NY.
6. Alison Benjamin, By (author) Brian McCallum, 2008. Keeping Bees and Making Honey. David & Charles, Newton Abbot.
7. Kim Pezza, 2013. Backyard Farming: Keeping Honey Bees: From Hive Management to Honey Harvesting and More. Hatherleigh Press, U.S.
8. Kim Flottum, 2014. The Backyard Beekeeper: An Absolute Beginner's Guide to Keeping Bees in Your Yard and Garden. Quarry Books.

Course II: BZT 118:- Techniques in Bee Keeping

Course Objective: Student should be able to…

1. Gain the knowledge about the bee keeping equipment's.
2. Understand the bee flora and floral calendar.
3. Identify bee flora and role of bee in pollination
4. Acquire the knowledge about pollen morphology and pollen types.

Total credits: 2 Unit No.	**Course II: Techniques in Bee Keeping**	**No. of hours per unit**
Unit I	**Bee keeping: Tools and Equipment:** ❖ Basic requirements of Tools for starting bee keeping: Getting Started in Beekeeping - Land and Buildings, Equipment and supplies. ❖ Bee keeping equipment - introduction to types of bee boxes - BIS standard Tools used in apiculture. ❖ Bee breeding multiplication of colonies - Queen reaching technique.	**08**
Unit II	**Honeybee Plants and Floral Calendar:** ❖ Bee flora - importance propagation - congenial conditions for starting up of apiculture. ❖ Migratory Bee Keeping - designing floral Calendar. ❖ Improved Agricultural practices - crop pollination - Pesticides impact on Honey bees	**08**
Unit III	**Food for Bees and Bee Flora:** ❖ Food for bees- Bee foraging, importance of pollen nectar and water for honey bees. ❖ Bee flora Morphology of flowering plant pollination & fertilization development of embryo & fruits. ❖ Floral structure & floral biology, Elements of classification & identification of important plant. ❖ Role of bee in pollination	**08**
Unit IV	**Pollen Morphology and Pollen Types** ❖ Pollen basket of forage, bees comb cells used for pollen storage, preparation of pollen side, pollen morphology. ❖ Morphological characteristic of pollen types, Bee bread	**06**

Course Outcomes: Student will be able to

1. Classify the bee keeping equipment's.
2. Categorize the bee flora and floral calendar.
3. Interpret bee flora and role of bee in pollination
4. Distinguish pollen morphology and pollen types.

Reference Books:

1. Ted Hooper, 2010. Guide to Bees and Honey: The World's Best Selling Guide to Beekeeping. Northern Bee Books. Oxford.
2. David Cramp, 2012. The Complete Step-by-step Book of Beekeeping: A Practical Guide to Beekeeping, from Setting Up a Colony to Hive Management and Harvesting the Honey. Lorenz Books. London.
3. Craig Hughes, 2010. Urban Beekeeping: A Guide to Keeping Bees in the City. e Good Life Press, Preston.
4. Ted Hooper, By (author) Clive De Bruyn, By (author) Margaret Thomas, 2014. The Beginner's Bee Book. Stenlake Publishing, Ayrshire.
5. Laidlaw, H.H., 1997. Contemporary queen rearing. Published by Dadant and Sons. R. A. Morse, Rearing queen honey bees. Wicwas press, NY.
6. Alison Benjamin, By (author) Brian McCallum, 2008. Keeping Bees and Making Honey. David & Charles, Newton Abbot.
7. Kim Pezza, 2013. Backyard Farming: Keeping Honey Bees: From Hive Management to Honey Harvesting and More. Hatherleigh Press, U.S.
8. Kim Flottum, 2014. The Backyard Beekeeper: An Absolute Beginner's Guide to Keeping Bees in Your Yard and Garden. Quarry Books.

BZP 119: Practical Based on Course 117 and 118

Course Objective: Student should be able to…

1. Gain the knowledge about the bee keeping equipment's.

2. Understand the bee flora and floral calendar.

3. Identify bee flora and role of bee in pollination

4. Acquire the knowledge about pollen morphology and pollen types.

Practical No.	Practical Based on Course BZT 117: Basics in Apiculture and BZT 118: Techniques in Bee Keeping	No. of hours per Practical
1	To study the morphology of Honeybees	**2**
2	Identification of different species and classes of Honey bees	**2**
3	Study of Bee keeping equipment	**2**
4	To Study different stages in life cycle of Honey bees	**2**
5	To study the behavior of Honeybees	**2**
6	Bee keeping unit - Handling of frames with colonies	**2**
7	Study of parts of Bee box	**2**
8	Colony inspection, maintenance - writing up of inspection report	**2**
9	Identification of swarming tendency in a colony - Removal of Drone cells	**2**
10	Identification of kinds of Queen cells.	**2**
11	Methods of Multiplication of Bee Colonies.	**2**
12	Steps for strengthening of colonies	**2**
13	Preparation of floral calendar	**2**
14	Study of Queen rearing	**2**
15	Field Visit	**2**

Course Outcomes: Student should be able to…

1. Gain the knowledge about the bee keeping equipment's.

2. Understand the bee flora and floral calendar.

3. Identify bee flora and role of bee in pollination

4. acquire the knowledge about pollen morphology and pollen types.

Reference Books:

1. Craig Hughes, 2010. Urban Beekeeping: A Guide to Keeping Bees in the City. e Good Life Press, Preston.
2. Ted Hooper, By (author) Clive De Bruyn, By (author) Margaret Thomas, 2014. The Beginner's Bee Book. Stenlake Publishing, Ayrshire.
3. Laidlaw, H.H., 1997. Contemporary queen rearing. Published by Dadant and Sons. R. A. Morse, Rearing queen honey bees. Wicwas press, NY.
4. Alison Benjamin, By (author) Brian McCallum, 2008. Keeping Bees and Making Honey. David & Charles, Newton Abbot.
5. Kim Pezza, 2013. Backyard Farming: Keeping Honey Bees: From Hive Management to Honey Harvesting and More. Hatherleigh Press, U.S.

Level 4.5 Semester II

BZT 121: Course III - CELL BIOLOGY, EVOLUTIONARY BIOLOGY (Credits: 02)

Course Objectives: Student should able to…

1. Learn about cells and cell organelles.
2. Define structure of organelles and chromosomal abnormality.
3. Acquired the knowledge about evolution theories
4. Identify types of fossils and causes of extinctions

Credits: 02 **Unit No.**	**BZT201: COURSE III - CELL BIOLOGY, EVOLUTIONARY BIOLOGY**	**No. of hours per unit**
UNIT I	**Cell Structure**	08
	❖ Cell theory and diversity in cell size and shape	
	Structure of Nucleus	
	❖ Nucleus with reference to Nuclear Membrane, Nucleoplasma, Chromatin and nucleolus.	
	❖ **Structure of Chromosome**	
	❖ With reference to morphology and organization (Nulceosome), Polytene Chromosome	
UNIT II	**U ltra Structure and Functions of the following**	08
	❖ Plasma Membrane (Fluid Mosaic Model)	
	❖ Mitochondria	
	❖ Endoplasmic reticulum	
	❖ Golgi Complex	
	❖ Lysosome	
	❖ **Diseases related chromosomes abnormality**	
	❖ **Sex linked**-Klinefelter's, and Turner's Syndrome	
	❖ **Autosomal Diseases** – Down's, Edward's and Patau's Syndrome.	
UNIT III	❖ **History of Life**	08
	❖ Major Events in History of Life	
	❖ **Introduction to Evolutionary Theories**	
	Lamarckism, Darwinism, Neo- Darwinism	
UNIT IV	❖ **Direct Evidences of Evolution**	06
	Types of fossils, Incompleteness of fossil record, dating of fossils	
	Extinction	

	Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of Extinction in evolution.	
	Total Contact Hours	**30**

Course Outcomes: Students will be able to…

1. Gain knowledge about cell and cell organelle.
2. Classify structure of organelle and chromosomal abnormality.
3. Categorize the different evolution theories.
4. Differentiate the types of fossils and causes of extinction.

Reference Books:

1. Eduardo De Robertis and De Robertis EME – *Cell and Molecular Biology*, 8th Edition. (Lea and Febiger, U.S., 2006) Pages 720.
2. C.B. Powar – *Cell biology*, (Himalaya Pub.House, 2010). Pages 215.
3. N. Arumugam, Cell biology, (Saras Publication, 2012). Pages 238.
4. P. S. Verma & V. K. Agarwal, *Cell biology , genetics , molecular biology, Evolution and Ecology*, (S. Chand and Company Ltd., 2005) Pages 1291.
5. R.P. Meyyan , N , Arumugam – *Genetics & Evolution* (Saras Publication, 2015).
6. P. K. Gupta – *Cell and Molecular Biology* V Edition (Rastogi Publication, 2017 Delhi) Pages 1192.
7. Mark Ridley, *Evolution*, III Edition, (Blackwell Publishing, 2004) Pages 778.
8. Nicholas Barton, Derek Briggs, Jonathan Eisen, David Goldstein, and Nipam Patel. *Evolution*. (Cold spring, Harbour Laboratory Press., 2007) Pages 833.
9. Brian Hall and Bendedikt Hallgrimsson. *Strickberger's Evolution*, IV Edition, (Jones and Barlett publishers Inc., 2008) Pages 760.
10. Neil Campbell and Jane Reece (2011), *Biology*, IX Edition, (Benjamin, Cummings, 2011) Pages 1263.

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BZT 202: Course IV – GENETICS (Credits: 02)

Course Objectives: Student should be able to…

1. Gain a basic understanding on human genetics and hereditary.
2. Define various terms of Genetics.
3. Real life situations and one's life the principles of human heredity.
4. Learn about chromosomal aberrations and its consequences.

Total Credits: 2 Unit No.	BZT 122: COURSE IV – GENETICS	No. of hours per unit
UNIT I	**Introduction to Genetics**	08
	❖ Mendel's work on transmission of traits, Molecular basis of Genetic information. Mendelian and post Mendelian Genetics	
	Principles of Inheritance, Incomplete dominance and co-dominance, gene interaction, Multiple alleles w.r.t. ABO, Rh blood groups and coat colour in rabbit.	
UNIT II	**Linkage, Crossing over**	06
	Linkage and process of crossing over, Coupling and repulsion theory, Cytological evidences of crossing over.	
UNIT III	❖ **Mutations**	08
	❖ Chromosomal mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and polyploidy, induced gene mutation. Genetic Counseling, Importance, Diagnosis of genetic / inherited diseases.	
UNIT IV	❖ **Sex Determination**	08
	Chromosomal theory of sex determination e.g. Insects, Sex linked inheritance- Colorblindness and Haemophilia.	

Course Outcomes: Students will be able to…

1. Understand Mendelian genetics, their principles and gene interaction.
2. Apply the principles of Rh blood groups.
3. Identify and describes various chromosomal mutations.

4. Interpret the clinical implications of genetic disorders.

Reference Books:

1. Verma P.S.and Agarwal V .K. – Genetics , S. Chand and company
2. Strick berger – Genetics . C Millian publications
3. Winchester –Genetics Oxford publication
4. Pritam Verma & Vishnu Agarwal, Cell biology, Genetics , molecular biology, Evolution and Ecology, (S. Chand Publisher, 2004), 1292 pp.
5. R.P. Meyyan , N , Arumugam – Genetics & Evolution
6. Eldon Gardner, Michael Simmons, Peter Snustad, (2008), *Principles of Genetics*, VIII Edition, (Wiley, 2008) Pages 740.
7. Peter Snustad and Michael Simmons, *'Principles of Genetics'*, V Edition , (John Wiley and Sons Inc., 2009) Pages 848.
8. William Klug, Michael Cummings and Charlotte Spencer, *Concepts of Genetics*. X Edition, (Benjamin Cummings, 2012).
9. Peter Russell, *Genetics A Molecular Approach* III Edition. (Benjamin cummings, 2009).
10. Anthony Griffiths, Susan Wessler, Richard Lewontin, and Sean Carroll. *Introduction to Genetic Analysis*. IX Edition , (W.H. Freeman and Company, 2007) Pages 800.

Practical II: BZP 123 **(credits: 02)**

Course Objectives: Student should be able to…

1. Learn a basic knowledge of Blood groupings and applications.
2. Learn Mendelian Inheritance and post mendelian modifications.
3. Co-relate human genetics with real life situations.
4. Learn about fossil evidences.

Total credits: 2 Practical No.	**Practical II:** BZP203 (Practical Based on BZT 121: Cell & Molecular Biology and Evolutionary Biology and BZT 122: Genetics)	**No. of Hours Per Unit**
1	**Demonstration/Identification of ABO and Rh blood groups**	**4**
2	**Demonstration/ Cytological Preparations**	**4**
	Mitochondria –Stained preparation of mitochondria from onion peeling / Hydrilla leaf /Oral mucosa by using Janus Green B .	**4**
3	Polytene Chromosome – Stained preparation of Polytene chromosome larva / Drosophila larva.	**4**
4	Study of fossil evidences from plaster cast models and pictures.	**4**
5	Darwin's Finches with diagrams / cut outs of beaks of different species	**4**
6	Study of Human Karyotypes	**4**
7	Diagnosis Test of inherited diseases	**4**
8	Study of Human Genetic traits (any five)	**4**
9	Example based on Monohybrid and dihybrid cross	**4**
10	Example based on Incomplete dominance and Co- dominance	**4**
11	Example based on Multiple alleles	**4**
12	Genetic traits	**4**
13	Example based on linkage and crossing over	**4**
14	Example based on gene interaction	**4**
15	Example based on gene mapping	**4**
	Total Contact Hours	**60**

Course Outcomes: Students will be able to…

1. Understand importance of blood group.
2. Solve various genetic examples.
3. Illustrate the process of evolution.
4. Form various plaster cast model and known their importance in fossil evidences.

Reference Books:

1. Practical Zoology by Kotpal 2007.
2. Brian Hall and Bendedikt Hallgrimsson. *Strickberger's Evolution*, IV Edition, (Jones and Barlett publishers Inc., 2008) Pages 760.
3. Edward Ruppert and Robert Barnes, *Invertebrate Zoology*, VIII Edition. (Holt Saunders International Edition, 2006). Pages 928.
4. Harvey Pough, *Vertebrate life*, VIII Edition , (Pearson International, 2009).
5. John Young. *The Life of Vertebrates* , III Edition. (Oxford university press, 2004).
6. Practical Zoology by Verma & Agarwal.
7. 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.

Level 4.5, Semester II

Minor Subject: Zoology

Course III: BZT: 124 ZOOGEOGRAPHY AND ECOLOGY (Credits: 02)

Course Objectives: Student should able to

1. Know the zoogeographical regions.
2. Learn the conservation and management with the help of zoogeography.
3. Get the knowledge about ecosystem.
4. Examine the population ecology

Total Credits: 2 UNIT No.	**Course III – ZOOGEOGRAPHY**	**No. of hours per unit**
UNIT I	**Zoogeographical regions and Patterns of Animal Distribution**	08
	❖ History and Introduction of Zoogeography ❖ **Zoogeographical regions**- 1. Palaearctic 2. Nearctic 3. Neotropical 4. Australian and Ethiopian regions 5. Oriental - their Climatic and faunal peculiarities ❖ Patterns of Animal Distribution:- 1. Cosmopolitan distribution 2. Discontinuous distribution, 3. Endemic distribution	
UNIT II	**Casual and Applied Zoogeography**	08
	❖ **Casual Zoogeography** 1. Ecological Zoogeography 2. Historical Zoogeography 3. Experimental Zoogeography ❖ **Applied Zoogeography** 1. Economic Production 2. Environment Assessment 3. Conservation Management 4. Sustainable use of resources	

	5. Landscape planning 6. Public health	
UNIT III	**Introduction to Ecology and Ecosystem**	
	❖ Introduction and scope of ecology ❖ components of ecosystem, 1. Abiotic components – Light, Temperature & Water 2. Biotic components – Producers, Consumers & Decomposers.	08
	❖ Types of Ecosystem: 1. Aquatic- Pond ecosystem 2. Terrestrial- Desert Ecosystem	
UNIT IV	**Population Ecology**	
	❖ Characteristics of Population 1. Natality 2. Mortality 3. Population Dispersal 4. Population density 5. Age distribution 6. Population Growth Form 7. Population Equilibrium and Fluctuation	**06**

Course Outcomes: Student will be able to…

1. Recognize the zoogeographical regions.
2. Apply the knowledge of zoogeography in conservation and Management.
3. Relate knowledge about ecosystem.
4. Categories the population ecology

Reference Books:

1. Colinvaux, P.A. (1993).Ecology. II Edition. Wiley, JohnandSons,Inc.
2. Krebs,C.J.(2001). Ecology.VI Edition. Benjamin Cummings.
3. Odum,E.P.,(2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Robert Leo Smith, Ecology and field Biology, Harper and Row publisher.
5. Ricklefs, R.E.,(2000). Ecology. V Edition. Chiron Press

Course IV: 125 BIODIVERSITY CONSERVATION (Credits: 02)

Course Objectives: Student should able to

1. Understand the types of biodiversity.
2. Identify the zones of faunal distribution and major protected areas.
3. Explain the Biodiversity Hot Spots and value of biodiversity.
4. Implement the knowledge for conservation of biodiversity.

Total Credits: 2 UNIT No.	**Course IV - BIODIVERSITY CONSERVATION**	**No. of hours per unit**
UNIT I	**Biodiversity:** Introduction of biodiversity, Types of Biodiversity Climatic Zones and Biodiversity Biodiversity as a natural resource	08
UNIT II	**Indian Biodiversity:** Vegetational Zones Zones of Faunal distribution Major protected areas & their importance	06
UNIT III	**Global Biodiversity and Value of Biodiversity:** ❖ Uses and Importance ❖ Major Biodiversity areas of the world ❖ Biodiversity Hot Spots ❖ Value of Biodiversity.	08
UNIT IV	**Conservation of Biodiversity**	08
	❖ Approaches: In situ conservation: ❖ National Parks ❖ Wildlife sanctuaries ❖ Ex situ conservation: ❖ Threats of biodiversity: loss of habitat, poaching, Man wildlife conflicts	

Course Outcomes: Students will be able to…

1. Describe the types of biodiversity.
2. Classify the zones of faunal distribution and major protected areas.
3. Describe the Biodiversity Hot Spots and value of biodiversity.
4. Apply the knowledge for conservation of biodiversity.

Reference Books:

1. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing.

2. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Coexistence? Cambridge University.

3. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Coexistence? Cambridge University.

4. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

BZP 126:- Practical Course Based on Course III and IV

Course Objectives: Student should able to

1. Learn the animals from geographical regions.
2. Get the knowledge about zoogeographical map from map.
3. Understand the different types of ecological pyramids
4. Identify different fauna.

Total Credits: 2 Practical No.	**Practical Course Based on Course III BZT 123: Zoogeography and Ecology and Course IV BZT 124: Biodiversity Conservation**	**No. of hours per unit**
1	Study of animals from discontinues distribution	**4**
2	To identify the animals from discontinues distribution from map	
3	Study of Animals from endemic distribution	**4**
4	To identify the endemic animals geographical distribution from map	**4**
5	Study of sub-regions from oriental regions	**4**
6	Study of Zoogeographical realms from the map	**4**
7	Study of population density	**4**
8	To study types of ecosystem	**4**
9	To study types ecological pyramids	**4**
10	Identification of threatened flora, mammalian fauna and herpeto fauna (Any 5 examples from each aspect)	**4**
11	Methods of conservation of biodiversity	**4**
12	Study of National parks from India	**4**
13	Study of Wildlife sanctuaries from India	**4**
14	Study of Endangered Species from India	**4**
15	Visit to National Park	**4**
	Total Contact Hours	**60**

Course Outcomes: Students will be able to…

1. Define the animals from geographical regions.
2. Differentiate zoogeographical regions from map.
3. Explain the different types of ecological pyramids
4. Classify different fauna.

Reference Books:

1. Biological Rhythms: Vinod Kumar (2002) Narosa Publishing.

2. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Coexistence? Cambridge University.

3. Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflict or Coexistence? Cambridge University.

4. Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

Level 4.5, Semester II

Course III: BZT 127: Bee Enemies and Diseases

Course Objective: Students should be able to…

1. Gain knowledge about bee-keeping equipments.
2. Understand the bee flora and floral calendar.
3. Identify bee flora and the role of bees in pollination
4. Acquire knowledge about pollen morphology and pollen types.

Total Credits: 2 Unit No.	**Course III: BZT 127: Bee Enemies and Diseases**	**No. of hours per unit**
Unit I	**Study of Bee enemies:** ❖ An introduction of Bee enemies ❖ Wax Moth ❖ Ants ❖ Wasps ❖ Microorganisms ❖ Pests ❖ Diagnosis and Identification.	**08**
Unit II	**Mites attacking honey bees:** ❖ Varroa mites ❖ Mite Biology ❖ Controlling Varroa Mites ❖ Mechanical control ❖ Mite-tolerant stocks ❖ Biopesticides ❖ Chemical (synthetic pesticide) treatments.	**08**
Unit III	**Study of Bee Diseases:** ❖ Bacterial, viral, fungal & protozoan diseases ❖ Bacterial disease - American Foulbrood, European Foulbrood ❖ Viral disease - Deformed Wing Virus, Sacbrood Viru, Black Queen Cell Virus, Kashmir Bee Virus, Acute Bee Paralysis Virus. ❖ Fungal disease - Chalkbrood, Stonebrood. ❖ Protozoan disease - Nosemosis, Nosema cerana	**08**
Unit IV	**Pesticide poisoning of bees:**	**06**

	❖ Definition of pesticides ❖ types of pesticides and their length of residual toxicity ❖ Pesticides and pollinators ❖ Toxicity to bees – Honey bee health, Colony collapse disorder.	
	Total	**30 Hrs.**

Course Outcomes: Student should be able to…

1. Gain the knowledge about the bee keeping equipment's.
2. Understand the bee flora and floral calendar.
3. Identify bee flora and role of bee in pollination
4. Acquire knowledge about pollen morphology and pollen types.

Reference Books:

1. David Cramp, 2012. The Complete Step-by-step Book of Beekeeping: A Practical Guide to Beekeeping, from Setting Up a Colony to Hive Management and Harvesting the Honey. Lorenz Books. London.
2. Craig Hughes, 2010. Urban Beekeeping: A Guide to Keeping Bees in the City. e Good Life Press, Preston.
3. Alison Benjamin, By (author) Brian McCallum, 2008. Keeping Bees and Making Honey. David & Charles, Newton Abbot.

Course IV: BZT 128 Bee Products, Economics and Marketing

Course Objective: Students should be able to…

1. Learn about the bee Bee products.
2. Understand the Value added honey products.
3. Identify the economic value of beekeeping and their products
4. Acquire the knowledge about the marketing of bee products.

Total credits: 2 Unit No.	**Course IV: Bee Products, Economics and Marketing**	**No. of hours per unit**
Unit I	**Bee products:** ❖ Introduction of Bee Products ❖ Honey ❖ Pollen ❖ royal jelly ❖ bees wax ❖ propolis & venom ❖ Significance of bee products	**08**
Unit II	**Value-added honey products:** ❖ Properties of honey products ❖ Nutrients and composition of honey ❖ Acid content and flavor effects ❖ Types of value-added honey products	**08**
Unit III	**Economics of beekeeping:** ❖ Economics in small-scale and large scale beekeeping ❖ Economic Value of Commercial Beekeeping. ❖ Economic Value of value-added products of honey.	**06**
Unit IV	**Marketing of bee products:** ❖ Definition of marketing ❖ Marketing Honey Comb and Honey ❖ Marketing Pollination Services ❖ Marketing Wax ❖ Marketing Propolis ❖ Marketing Pollen and Marketing Royal Jelly ❖ Marketing Bee Venom ❖ Marketing Adult and Larval bees ❖ Costing and Financing the Marketing Activities.	**08**

Total Hours	**30 Hrs**

Course Outcomes: Students should be able to…

1. Explain the Bee products.

2. Classify the Value added honey products.

3. Recognize the economic value of beekeeping and their products

4. Apply knowledge about the marketing of bee products.

Reference Books:

1. Kim Flottum, 2014. The Backyard Beekeeper: An Absolute Beginner's Guide to Keeping Bees in Your Yard and Garden. Quarry Books.

2. Kim Pezza, 2013. Backyard Farming: Keeping Honey Bees: From Hive Management to Honey Harvesting and More. Hatherleigh Press, U.S.

3. Alison Benjamin, By (author) Brian McCallum, 2008. Keeping Bees and Making Honey. David & Charles, Newton Abbot.

4. Alison Benjamin, By (author) Brian McCallum, 2008. Keeping Bees and Making Honey. David & Charles, Newton Abbot.

5. Alison Benjamin, By (author) Brian McCallum, 2008. Keeping Bees and Making Honey. David & Charles, Newton Abbot.

6. Laidlaw, H.H., 1997. Contemporary queen rearing. Published by Dadant and Sons. R. A. Morse, Rearing queen honey bees. Wicwas press, NY.

BZP 129: Practical Based on Course 127 and Course 128

Course Objective: Student should be able to…

1. Learn about the bee Bee products.

2. Understand the Value added honey products.

3. Identify economic value of bee keeping and their products

4. Acquire the knowledge about marketing of bee products.

Practical No.	Practical Based on Course III BZT 127 Bee enemies and diseases and IV BZT 128 Bee Products, Economics and Marketing	No. of hours per Practical
1	Study of natural enemies and predators of honey bee	**2**
2	Study of Bacterial diseases of honey bee	**2**
3	Study of Viral diseases of honey bee	**2**
4	Study of Fungal diseases of honey bee	**2**
5	Preventive and control measures of diseases of honey bee	**2**
6	Study of Honey extraction, process	**2**
7	Study of Bees wax rendering, purification	**2**
8	Study of Royal jelly preparation process.	**2**
9	Study of value added honey product preparation.	**2**
10	Study of Commercial bee keeping	**2**
11	Study of marketing management of honey and honey comb.	**2**
12	Study of medicinal properties of honey	**2**
13	Visit to Apairy Unit	**2**
14	Visit to honey production unit	**2**
15	Case Study	**2**
	Total	**30 Hrs**

Course Outcomes: Student should be able to…

1. Define the bee Bee products.

2. Classify the Value added honey products.

3. Recognize economic value of bee keeping and their products

4. Apply the knowledge about marketing of bee products.

Reference Books:

1. David Cramp, 2012. The Complete Step-by-step Book of Beekeeping: A Practical Guide to Beekeeping, from Setting up a Colony to Hive Management and Harvesting the Honey. Lorenz Books. London.
2. David Cramp, 2009. A Practical Manual of Beekeeping: How to Keep Bees and Develop Your Full Potential as an Apiarist. Spring Hill, London.
3. Ted Hooper, 2010. Guide to Bees and Honey: The World's Best Selling Guide to Beekeeping. Northern Bee Books. Oxford.
4. Roger A. Morse, Kim Flottum, 1998. Honey Bee Pests, Predators and Diseases. WicwasPr; 3rd edition.
5. Alethea Morrison (Author), Mars Vilaubi (Photographer), 2013. Homegrown Honey Bees: An Absolute Beginner's Guide to Beekeeping Your First Year, from Hiving to Honey Harvest. Storey Publishing, LLC; 1 edition.
6. Hunt, G.J., 2000. Using honey bees in pollination Purdue University.
7. Craig Hughes, 2010. Urban Beekeeping: A Guide to Keeping Bees in the City. e Good Life Press, Preston.

Department of Zoology

Paper-Indian Knowledge System (Indian Health Science)

Course Title: IKS 101:- Basic concepts in Ayurveda

Credit:-02 **Hours:-30**

Course Objective: Students should be able to

1. Recall the concept of Ayurveda.
2. Enlist of Pancha Mahabhutas
3. Describe the Concept of nutrition in Ayurveda
4. Identify preventive approaches for good health

Credits (Total Credits 2)	**Basic concepts in Ayurveda**	**No. of hours per unit**
Unit – I	**UNIT-I: Basic Of Ayurveda** • Definition of Ayurveda • Aim of Ayurveda • Scope of Ayurveda • Concept of Health according to Ayurveda	**(07)**
Unit – II	**Principles and Significance of Ayurveda** • Pancha Mahabhuta Concept • Tridosha Concept(vata, pitta. Kapha) • Concept of Prakruti (Body Constitution) • Concept of Vikurti • Concept of Sapta Dhatu (Body Elements) • Concept of Mala (Waste Products) • Concept of Srotas (Body Channels) • Concept of Agni (Digestive Fire) • Concept of Koshta (Alimentary Tract)	**(09)**
Unit – III	**Concept of Nutrition in Ayurveda** • Concept of Ayurvedic Ahara (Diet) • Concept of Ayurvedic Nutrition • The role of spices in Ayurvedic Ahara (Diet) • Benefits of the Ayurvedic Ahara (Diet)	**(07)**
Unit – IV	**Preventive approaches for good health** • Concept of Vihara (Lifestyle) in Ayurveda • Dinacharya (Daily regimen) • Rithucharya (Seasonal regimen) • Sada vritta (Ethical Regimen): Rules of good conduct • Dhamiya & Adhamiyavega (Preventive Regimens)	**(07)**

Course outcomes: Student will be able to

1. Memorize the Concept of Ayurveda.
2. Discuss Principles and Significance of Ayurveda
3. Classify Concept of nutrition in Ayurveda
4. Implement preventive approaches in real life.

Reference Books:

1. Ayurvediya Padartha Vigyana Vaidya--Ramkrishna Sharma Dhand
2. Ayurvediya Padartha Vigyan Parichaya --Vaidya Banwarilal Gaur
3. Ayurvediya Padartha --Darshan Pandit Shivhare
4. Ayurveda Ka Itihas –Kavira Suram Chand
5. Ayurveda Sutra --Rajvaidya Ram Prasad Sharma
6. History of Indian Medicine (1-3 part)-- Dr. GirindrNath Mukhopadhyaya
7. Ancient Indian Medicine-- Dr. P. Kutumbia
8. http://ccras.nic.in/sites/default/files/ebooks/24052018_CCRAS_Cardiac_disorders.pdf
9. https://vikaspedia.in/health/ayush/ayurveda-1/ayurveda-based-dietary-guidelines-for-mental-disorders/the-concept-of-ahara-diet-in-ayurveda

Level 4.5, Semester II

Skill Enhancement Course

SEC 103: Cocoon handicraft technician

Course Objective: Students will be able to…

1. To explore the usage of cocoons shells as a alternative biomaterial for making creative artifacts.

2. To apply the artistic skills for preparing creative products from cocoons.

Total Credits: 1 **Unit No.**	**SEC 103: Cocoon handicraft technician**	**No. of hours per unit**
UNIT I	❖ **Selection Raw material and tools** ❖ Collection of cocoons ❖ Different shapes of cocoon shell ❖ types of cocoons ❖ required tools for cutting of cocoon shell	8
Unit II	Processing of dying of cocoon	7
	❖ Preparation of herbal dye colours, ❖ Process of dying of cocoon shell ❖ Drying Process ❖ Cleaning Methods ❖ Methods of cutting of cocoon shell ❖ Assembling of colour cocoon ❖ Selection of quality cocoons ❖ Preparation of best quality cocoon artifacts	
	Total Contact Hours	**15**

Course Outcomes: Students should be able to…

1. Utilize their skills in selecting quality raw materials for preparation of cocoon handicrafts

2. Prepare creative cocoon products and develop their entrepreneurial skills to scale up its market.

Reference Books:

1. https://uni-mysore.ac.in/english version/sites/default/files/content/sericulture_new.pdf
2. https://www.dsource.in/resource/silk-cocoon-handicrafts/tools-and-raw-materials
3. Sathe, T.V. and Jadha v, A.D. 2001. Sericulture and Pest Management, Daya Publishing, Delhi.

4. Sinha, H. 2008. The Development of India Silk. Oxford and IBH Publishing Co. Ltd. New Delhi.

Practical based on Paper I

Course Objectives: Students will be able to -

1. Identify the sources of collection of raw materials for making cocoon handicrafts
2. Create their own products and improve their entrepreneurial skills.

Total Credit= 1 Practical No.	Name of Practical	Total No. of hours 30
1.	Study on Selection of raw of materials for cocoon handicrafts	
2.	Methods for cleaning the cocoons	
3.	Study on usage of various tools for cocoon handicrafts	
4.	Dyeing techniques of cocoons	
5.	Cutting techniques of cocoon selected for handicrafts	
6.	Preparation of Garlands	
7.	Preparation of fashion accessories from cocoons	
8.	Preparation of flower bouquets	
9.	Preparation of miniature handicrafts	
10.	Preparation of greeting cards	

Course outcomes: Students should be able to -

1. Curate the quality raw materials used in preparation of cocoon handicrafts
2. Develop their own cocoon products and market it on large scale.