SYLLABI AND SCHEME OF EXAMINATIONS
FOR
SKILL ENHANCEMENT COURSES
FOR
UG PROGRAMMES OFFERED BY DEPARTMENT OF ZOOLOGY

(Based on Curriculum and Credit Framework for UG Programs under NEP)

WITH EFFECT FROM
THE
SESSION 2024-25

MAHARSHI DAYANAND UNIVERSITY
ROHTAK (HARYANA)

SYLLABI AND SCHEME OF EXAMINATIONS FOR SKILL ENHANCEMENT COURSES FOR UG PROGRAMMES OFFERED BY DEPARTMENT OF ZOOLOGY

Skill Enhancement Course (SEC)	Nomenclature of Course	Course Code	Credits Distribution			Total Credits	Workload			Total Workload	Marks				
			L	T	P		L	T	P		Theory		Practical		Total Marks
											Internal	External	Internal	External	
SEMESTER 1 (2024-25)															
SEC 1 @ 3 credits	**Apiculture**	**24ZOO401SE01**	2	-	1	3	**2**	**0**	**2**	**4**	15	35	05	20	75
SEMESTER II (2024-25)															
SEC 2 @ 3 credits	**Pest Management**	**24ZOO402SE01**	2	-	1	3	**2**	**0**	**2**	**4**	15	35	05	20	75
SEMESTER III (2025-26)															
SEC 3 @ 3 credits	**Microtomy**	**25ZOO403SE01**	2	-	1	3	**2**		**2**	**4**	15	35	05	20	75
SEMESTER VI (2025-26)															
SEC 4 @ 2 credits (offered only in case of Single Major Programme)	**Sericulture**	**25ZOO404SE01**	1	-	1	2	1	0	2	3	5	20	5	20	50
SEMESTER VII (2026-27)															
SEC 5 @ 4 credits (if offered as an option) Any one	**Management of Wildlife Or Limnology**	24ZOO201SE01 OR 24ZOO201SE02	2	-	2	4	2	0	4	6	15	35	15	35	100
SEMESTER VIII (2026-27)															
SEC 6 @ 4 credits (if offered as an option)	**Aqua farming Or Bee Keeping**	24ZOO202SE01 OR 24ZOO202SE02	2	-	2	4	2	0	4	6	15	35	15	35	100

L: Lecture; T: Tutorial; P: Practical

SYLLABI AND SCHEME OF EXAMINATIONS FOR SKILL ENHANCEMENT COURSES FOR UG PROGRAMMES OFFERED BY DEPARTMENT OF ZOOLOGY

Semester ....I....

Session: 2024-25

Name of Program	**B.Sc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Apiculture**	**Course Code**	**24ZOO401SE01**
Hours per Week	**4**	**Credits**	**3=(2+0+1)**
Maximum Marks	**75**	**Time of Examinations**	**3HRS.**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
1. Students will be able to understand the significance of honey bees and Apiculture
2. Students will acquire knowledge about different species and castes of the honey bees
3. Students will learn to manage beehives for honey production and pollination, and Learn various product of honey
bees and value addition in these products,
4. Students will be aware about economic importance of honey bees, and use of Apiculture for employment, self
employment and conservation of nature
5. Students will gain practical knowledge about various methods of bee keeping and extraction of honey thus create
scope for entrepreneurship.

Unit 1:
Apiculture meaning, definition scope and history
Status of Apiculture Industry in India
Classification and Life Cycle of Honey Bee.
Identification of Indigenous and exotic Honey bee species

Unit 2:
Cultivable species of Honey Bee with reference to India
Social organization of honey bees: the castes- queen, drone and workers,
Nesting behavior of Honey bees, Bee foraging, Seasonal management, swarming
in Honey bees, waggle dance, defense in honey bees
Diseases and Enemies. of Bees ,Control and Preventive measures.

Unit 3:
Role of Bees in cross pollination in horticulture and agriculture
Methods of Artificial Bee keeping
Equipments used in Bee keeping Industry
Methods of extraction of Honey and other products

Unit 4:
Products of Apiculture Industry and their Uses (Honey, Bee Wax, Royal Jelly, Bee Venom, Propolis and Pollen)
Bee Keeping Industry: Present and future
Prospects of apiculture as self employment venture.
Economics of Apiculture: Expenditure, Net Income, and Additional benefits

References:

1. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
2. Bisht, D.S. (2004). Agricultural Development in India, Anmol Pub. Pvt. Ltd.
3. Singh S. (1964). Beekeeping in India, Indian council of Agricultural Research, NewDelhi
4. Mehrotra, K.N. Bisht, D.S. (1981). Twenty-five years of apiculture research at IARI. I. Apiculture in relation to
5. agriculture.
6. The Social Behaviour of the Bees, 1974 : By Missioner C.D

Practical's: based on the theory content

Semester ....II...

Session: 2024-25

Name of Program	**B.Sc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Pest management**	**Course Code**	**24ZOO402SE01**
Hours per Week	**4**	**Credits**	**3=(2+0+1)**
Maximum Marks	**75**	**Time of Examinations**	**3HRS.**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
1. Students will able to understand ecologically important and harmful insects.
2. Will be able to recognize life cycle of crop insects
3. It will make the students understand about the vegetable pest
4. Students will be able to explain about various pest control approaches
5. Students will be able to identify various insect and pest species

Unit 1:
Study of important insect pests of crops and vegetables:
Sugarcane: (With their systematic position, habits and nature of damage caused.

(a) Sugarcane leaf-hopper *(Pyrilla perpusilla)*
(b) Sugarcane Whitefly *(Aleurolobus barodensis)*
(c) Sugarcane top borer *(Sciropophaga nivella)*
(d) Sugarcane root borer *(Emmalocera depresella)*
(e) Gurdaspur borer *(Bissetia steniellus)*
Life cycle and control of *Pyrilla perpusilla* only.
Cotton: (With their systematic position, habits and nature of damage caused.
(a) Pink bollworm (*Pestinophora gossypfolla)*
(b) Red cotton bug *(Dysdercus cingulatus)*
(c) Cotton grey weevil (*Myllocerus undecimpustulatus)*
(d) Cotton Jassid (*Amrasca devastans)*
Life cycle and control of *Pectinophore gossypiella*

Unit 2:
Wheat: Wheat stem borer (*Sesamia inferens)* with its systematics position, habits, nature of damage caused. Life cycle and control methods.
Paddy: (With their systematic position, habits and nature of damage caused)
(a) Gundhi bug (*Leptocorisa acuta)*
(b) Rice grasshopper *(Hieroglyphus banian)*
(c) Rice stem borer *(Scirpophaga incertullus)*
(d) Rice Hispa *(Diceladispa armigera)*
Life cycle and control of *Loptocorisa acuta* only.

Unit 3:
Vegetables: (Their systematics position, habits and nature of damage caused.
(a) *Aulacophora faveicollis* – The Red pumpkin beetle.
(b) *Dacus cucurbitas* – The pumpkin fruit fly.
(c) *Tetranychus tecarius* – The vegetable mite.
(d) *Epilachna* – The Hadda beetle
Life cycle and control of *Aulacophora faveicollis*
Stored grains: (Their systematic position, habits and nature of damage caused.
(a) Pulse beetle *(Callosobruchus maculatus)*
(b) Rice weevil *(Sitophilus oryzae)*
(c) Wheat weevil *(Trogoderma granarium)*
(d) Rust Red Flour beetles *(Tribolium castaneum)*
(e) Lesser grain borer *(Rhizopertha dominica)*
(f) Grain & Flour moth *(Sitotroga cerealella)*
Life cycle and control of *Trogoderma granarium*)

Unit 4:
Important bird and rodent pests of agriculture & their management.
Pest control: Biological control, its history, requirement and precautions and feasibility of biological agents for control.
Chemical control: History, Categories of pesticides, important pesticides from each category to pests against which they can be used, insect repellents and attractants. Integrated pest management

References:
1. David Dent , Richard Binks (2020). Insect Pest Management CABI Publishing; 3rd edition
2. Larry P Pedigo , Marlin E. Rice (2014) Entomology and Pest Management. Waveland Pr Inc; 6th edition
3. John R. Ruberson (2019) Handbook of Pest Management, CRC Press; 1st edition

4. Kalatia M.K. (2021) Introduction to principles of pest and disease management; Walnut Publication
5. Smith K M (2013) A Textbook of Agricultural Entomology by Hill, Cambridge University Press

Practical's: based on the theory content

Semester ....III...
Session: 2025-26

Name of Program	**B.Sc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Microtomy**	**Course Code**	**25ZOO403SE01**
Hours per Week	**4**	**Credits**	**3=(2+0+1)**
Maximum Marks	**75**	**Time of Examinations**	**3HRS.**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
1. Students will have thorough understanding of modern development in microtomy.
2. Learners will be able to process animal samples for permanent slide preparation.
3. Gain knowledge regarding various biological stains.
4. Localize histochemical of proteins, lipids and nucleic acids.
5. Students will get practical exposure of Microtomy

Unit 1:
Microtomy:- Introduction, definition, History and Applications in Biological sciences; Types of microtomes- Rotary microtome, Sledge Microtome and Cryomicrotome

Unit 2:
Collection and transportation of sample/specimens for histological examination; Basic concepts of fixation- Various types of fixatives used in microtomy; Process of fixation; Embedding-Block formation

Unit 3:
Section Cutting: Paraffin section cutting ; Streching- Spreading the sections and attachment to the glass slides; Staining – Principle and procedure; Preparation of Stains and solvents

Unit 4:
General Staining Procedures for Paraffin Embedded tissue; Nuclear Stains and Cytoplasmic stains- Haematoxylin and Eosin staining, Mercury Bromophenol Blue staining; Toulidine Blue; Commonly used mountants in microtomy.

References:
1. Principles and interpretation of laboratory practices in surgical pathology by S. S.and Kaler Amrit Kaur
2. Practical approach to histopathology staining and microtomy by Prof. Punit Puri
3. Histopathology Techniques and it's management by Ramdas Nayak.
4. Troubleshooting histopathology stains by Richard.W. Horobin and John D. Baneroft.

Practical's: based on the theory content

Semester ....VI...

Session: 2026-27

Name of Program	**B.Sc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Sericulture**	**Course Code**	**25ZOO404SE01**
Hours per Week	**3**	**Credits**	**2=(1+0+1)**
Maximum Marks	**50**	**Time of Examinations**	**3HRS.**

Note:
Examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, examiner will set two questions from each unit and the candidates will be required to attempt one question from each Unit. All questions will carry equal marks.

Course Learning Outcomes (CLO):
The main objective of paper is to give the students a thorough understanding of the subject giving adequate weightages to both the core content and techniques used in Sericulture.

Unit 1:
Silkworm taxonomy & life-cycle.

Unit 2:
Silkworm morphology: Morphology of the egg, larva, pupa, adult. Silkworm Anatomy: Digestive system: Larva, Circulatory system: Larva, pupa, adult, Nervous system: Larva, adult, Silk gland: Larva, Reproductive system: Adult.

Unit 3:
Silkworm Rearing (C.S.B. proposed model rearing house), Rearing appliances, disinfection, disinfectants, bed cleaning, feeding of worms.

Unit 4:
Mounting and mountage, process of spinning, cocoon harvesting, Rearing method: chawki rearing or young age worm rearing. Late age Silkworm rearing.

References:
1. Ganga, g., and j. Sulochana chetty. (1991) an introduction to sericulture. Oxford & ibh publishing company.
2. Krishnaswami, s.; narasimhanna, m.n.; suryanarayan, s.k and kumararaj, s. (1973) sericulture manual-2 - silkworm rearing. Agriculture service bulletin, fao, rome.

Practical's: based on the theory content

Semester **- VII**

Session: **2027–28**

Name of Program	**B.Sc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Management of Wild Life**	**Course Code**	**24ZOO201SE01**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3HRS.**

Note:
The examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, the examiner will set two questions from each unit and the candidates will be required to attempt one question from each. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO1: Know about an overview of Indian Biodiversity
CLO 2: Understand various strategies of biodiversity conservation
CLO 3: Improve their knowledge about Important Protected areas
CLO 4: To know about the various animal projects.

Unit-I
Wildlife: Definition, significance and wildlife zones of the world and India, Protected Area Systems, Present status of National PA-Systems. Theory and Practice of Biosphere Reserves of the world: Biosphere Reserves of India.

Unit-II
Wildlife Damage, electric fences for wildlife damage control, Basic electric fence design, Trench design, line trapping, Mist netting, Rocket netting Chemical capture: Equipment, Drugs, Plan of operation. Poaching: Its implications, conducting anti-poaching operations.

Unit-III
Natural Heritage sites, Wildlife and livelihood; Wildlife and illegal trade & control. Wildlife conservation techniques, Role of WWF, IUCN, UNEP, Red Data Book; Categories of Endangered Wildlife Species.

Unit-IV
National Projects: Project Tiger, Project elephant, Project Rhinoceros, Project Crocodiles, Project Lion, Project Dolphin, Project Hangul, Project Snow Leopard, Project Cheetah

References:
1. Techniques for wildlife Census in India by W.A. Rogers (A field mannual); Wildlife Institute of India, Dehradun.
2. Wildlife Wealth of India by T.C. Majupuria; Tecpress Services, L.P., 487/42-SOL Wattenslip, Pratunam , Bangkok, 10400, Thailand
3. Ali, S. Ripley S.D. Handbook of Birds of India, Pakistan 10-Vols. Oxford University Press, Bombay.
4. The Book of Indian Animals by S.H. Prater, BNHS-Publication, Bombay.
5. Wildlife in India by V.B. Saharia Natraj Publishers, Dehradun.

Practical's: based on the theory content

OR

Name of Program	B.Sc. Zoology Single Major	Program Code	USZOO4
Name of the Course	Limnology	Course Code	24ZOO201SE02
Hours per Week	6	Credits	4=(2+0+2)
Maximum Marks	100	Time of Examinations	3HRS.

Note:
The examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, the examiner will set two questions from each unit and the candidates will be required to attempt one question from each. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO1: Know about the key principles, concepts and techniques in freshwater ecosystems
CLO 2: Understand an integrated view of the functioning and dynamics of surface freshwater ecosystems and a practical understanding of the critical linkages between their hydrological, geomorphologic, biogeochemical and ecological components
CLO 3: Improve their ability about the deeper understanding of professional, societal and ethical responsibility associated with sustainable water and water resources management

Unit-I
Principles for Freshwater Ecosystems:
Hydrological cycle, Biogeochemical cycles (C, N, P)
Structure and function of aquatic ecosystems (decomposition, primary & secondary production, trophic interaction).

Unit-II
Aquatic Ecosystems:
Lake ecosystems (oligotrophic / eutrophic; littoral / pelagic)
Wetland ecosystems (natural / manmade), Running-water ecosystems (headwaters to mouth: RCC).

Unit-III
Sampling techniques in aquatic ecosystems (theory and practice): Open-channel flow (velocity measurements), Water quality (field & laboratory analyses), Population assessment (field & laboratory analyses).

Unit-IV
Mans influence on aquatic systems with examples from Kristianstads Vattenrike Biosphere Reserve
Eutrophication
Acidification
Brownification.

References:
Wetzel, Robert G (2001), *Limnology: Lake and River Ecosystems*. 3 edition. San Diego: Academic Press (350 p).

Practical's: based on the theory content

Semester **- VIII**

Session: **2027–28**

Name of Program	**B.Sc. Zoology Single Major**	**Program Code**	**USZOO4**
Name of the Course	**Aqua Farming**	**Course Code**	**24ZOO202SE01**
Hours per Week	**6**	**Credits**	**4=(2+0+2)**
Maximum Marks	**100**	**Time of Examinations**	**3HRS.**

Note:

The examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, the examiner will set two questions from each unit and the candidates will be required to attempt one question from each. All questions will carry equal marks.

Course Learning Outcomes (CLO):

CLO1: Students will understand about aquatic animals of India

CLO 2: Students will capable to undertake about crafts and gears

CLO 3: It will make the students understand about the seed production in aquatic animals

CLO 4: Students will be able to explain the culture technology in fishery

CLO 5: Students will be able to identify the aquatic animals

Unit 1:

Introduction to world fisheries: Production, utilization and demand, Major species cultured Fresh Water fishes of India: River system, reservoir, pond, tank fisheries; captive and culture fisheries, cold water fisheries.

Unit 2:

Fishing crafts and gears. Fin fishes, Crustaceans, Molluscs and their culture. Traits of important cultivable fish and shellfish and their culture methods – Indian major carps, exotic carps, air breathing fishes, cold water fishes, freshwater prawns, mussels

Unit 3:

Seed production: Natural seed resources – its assessment, collection, Hatchery production Nutrition: Sources of food (Natural, Artificial) and feed composition (Calorie and Chemical ingredients).

Unit 4:

Field Culture: Culture, Culture in Pond-running waters; recycled water culture, cage culture; poly culture. Culture technology: Induced breading in fishes, techniques and hormones; Fish Biotechnology (Transgenesis and Cryopreservation of gametes).

References:

1. Arumugam N. (2014). Aquaculture and Fisheries, Saras Publication.
2. Bardach, JE, Ryther & McLarney, Wo (1972) Aquaculture, New York: Wiley-Interscience. 896pp.
3. Lagler, KF, Bardach, JE, Miller, RR & Passino, DRM (1977) Ichthyology, 21nd Edition, New York, Wiley, 506 pp.
4. Khanna S S, & Singh H R (2014). Textbook of Fish Biology and Fisheries 3rd edn. Narendra Publishing House

Practical's: based on the theory content

OR

Name of Program	B.Sc. Zoology Single Major	Program Code	USZOO4
Name of the Course	Bee Keeping	Course Code	24ZOO202SE02
Hours per Week	6	Credits	4=(2+0+2)
Maximum Marks	100	Time of Examinations	3HRS.

Note:
The examiner will set nine questions and the candidates will be required to attempt five questions in all. Question number one will be compulsory containing short answer type questions from all units. Further, the examiner will set two questions from each unit and the candidates will be required to attempt one question from each. All questions will carry equal marks.

Course Learning Outcomes (CLO):
CLO1: Provide a basic understanding of Apiculture practices
CLO2: Understanding of honey bees Social Organizations
CLO3: Familiarization with the Structure of Honeybee
CLO4: overview of bee comb/colony/flora etc.

Unit 1:
Overview of Beekeeping History
Species Diversity
Social Organizations
Structure of Honeybee

Unit 2:
Starting of Beekeeping
Bee Flora and Pollination
Bee Flora
Bee Pollination

Unit 3:
Products Collected and Synthesized by Bees
Honey
Bee's Wax
Royal Jelly
Bee Venom

Unit 4:
Marketing, Economics and Development Programmes
Marketing of Bee Products
Economics of Beekeeping
Developmental Programmes

References:

1. Commercial Beekeeping 2023. Dharm Singh Scientific Publishers
2. The Hive and the Honey Bee Revisited: An Annotated Update of Langstroth's Classic – Roger Hoopingarner, Wicwas Press, 2014
3. The Beekeepers Handbook – Diana Sammataro and Alphonse Avitabile, Comstock Publishing Associates 2021

Practical's: based on the theory content