

Binod Bihari Mahto Koyalanchal University, Dhanbad

Subject: Zoology

FYUGP _NEP2020 (from session 2023 onwards)

UG Syllabus

Minor from Vocational

Semester II

Minor – 2A (MN-2A) Apiculture – Entrepreneurship in Bee-Keeping

Credit – 4

Lectures – 60 Hours

FM = 75((No Internal Examination)+ 25 Skill test/Viva voce/Practical/Demonstration

Instructions:

- In all nine questions to be set there shall be two groups, i.e., **A** and **B**.
- **Group A** is compulsory which will contain three questions.
- Question no. **1** will be very short answer type/ Objective type consisting of five questions of **1 mark** each.
- Question no. **2 & 3** will be of short answer type of **5 marks** each.
- **Group B** will contain descriptive type, six questions* of **Fifteen marks** each, out of which any four to be answer.

*Question no.9 will be short answer type. There will be four options of which any two to be answered carrying equal marks covering the whole syllabus.

Learning Outcomes:

After successfully completing this course, the students will be able to:

1. Explain what are the prerequisite to get started in beekeeping
2. Explain the varieties of honey bee and their significance
3. Discuss the responsibilities of urban beekeepers
4. Identify where to purchase equipment and demonstrate how to assemble it
5. Name and identify major parts of the honey bee such as the stinger or mandibular parts
6. Describe bee biology and anatomy from the perspective of managing bees
7. Describe the importance of wax and identify what to look for in comb during hive inspections

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Unit	Topic	Total no. of Lectures
Unit 1:	General Morphology, Types and Behaviour of Honey Bees.	
1.1	Major Types of Economically Important Honeybees, Stingless Honey bee,	3
1.2	General Morphology, Behaviour and Life Cycle	2
1.3	Social Organization in Honey bee: Polymorphism, Cast System and Division of Labour,	4
1.4	Introduction to bee flora, Some important Bee Flora and their General Characters	3
Unit 2:	Introduction to Apiculture:	
2.1	History of beekeeping, beekeeping in India and World wide	2
2.2	Traditional Bee-keeping, Modern Bee-keeping, Urban Bee-keeping	3
2.3	Selection of Bee species, Setting up an Apiary. Rearing Equipment, Handling of Bees	4
2.4	Bee- keeping Equipment: Bee Box (Newton and Langstroth box), Tools and Artificial Diet	4
Unit 3:	Diseases of Honey Bee and their Management	
3.1	Pests of Honey bees and their Management	3
3.2	Diseases of Honey bee: Viral, Bacterial, Fungal, and Protozoan causing diseases	4
3.3	Management and their Treatments.	2
Unit 4:	Economics of Bee Keeping and their Products	
4.1	Honey Extraction Techniques, Physico-chemical Analysis of Honey, and Uses	4
4.2	Other Products of Apiculture Industry: Bee Wax, Pollens, Royal Jelly, Propolis and Bee Venom and its Uses.	4
4.3	Expenditure, Net Income, and Additional benefits. Honey Mission Program of KVIC	3

Books Recommended

1. Abrol , D. P. (1997) Bees and Beekeeping. Kalyani Publisher, New Delhi. 172
2. Abrol, D. P. (2010) A Comprehensive guide to Bees and Beekeeping. Scientific Publisher, New Delhi.
3. Withhead, S. B. (2010) Honey bees and their management Axis books Publisher, Jodhpur.
4. Nagaraja, N. and Rajagopal, D. (2013) Honey bees: Diseases, Parasites, Pests, Predator and their management. M.J.P Publisher, Chennai.
5. Dharam Singh and Singh, D. P. A Handbook of Beekeeping, Agrobios India (Publisher), Jodhpur.
6. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
7. Sardar Singh. Beekeeping in India, Indian Council of Agricultural Research, New Del

Demonstration /field visits /Laboratory work based on the above theory content.**FM = 25** [End Semester = 25] no Internal Examination

Sl. No	Suggested Practical	Marks Distribution
1.	Identify and Comment on (Cast of Honey bee/ Honey comb)	05
2.	Equipment used in Apiculture	05
3.	Spotting (2) a. Pest of Honey bee b. Products of Honey bee	2.5x2 =05
4.	Class record and/or Project Report	05
5.	Viva voce	05
Total		25

Suggested Practical**Apiculture – Entrepreneurship in Bee-Keeping**

1. Key to identify Cast of Honey Bee (Queen, Drone and Workers); Honey Comb.
2. Equipment used in Apiculture: Newton and Langstroth Box (Hive frames, Queen Excluder, Brood Chamber); Newton's Hive; Smoker; Honey Extractor; Drone trap and Pollen Trap.
3. Pests of honey bees
4. Field Work: Field visit to sight of Apiculture farm.

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Subject: Zoology

FYUGP _NEP2020 (from session 2023 onwards)

UG Syllabus

Minor from Vocational

Semester IV

Minor – 2B (MN-2B) Aquaculture and Fishery

Credit – 4

Lectures – 60 Hours

FM = 75((No Internal Examination)+ 25 Skill test/Viva voce/Practical/Demonstration

Instructions:

- In all eight questions to be set there shall be two groups, i.e., A and B.
 - Group A is compulsory which will contain three questions.
 - Question no. 1 will be very short answer type/ Objective type consisting of five questions of 1 marks each.
 - Question no. 2 & 3 will be of short answer type of 5 marks each.
 - Group B will contain descriptive type, Six (6) questions* of Fifteen (15) marks each, out of which any four (4) to be answer.
- *Question no. 9 will be short answer type. There will be four options of which any two to be answer carrying equal marks covering the whole syllabus.

Learning Outcomes:

After successfully completing this course, the students will be able to:

1. Understand aquaculture and fishery, encompassing the theoretical knowledge, practical applications, and its economic importance to society.
2. Learn the small-scale fish farming and its commercial level of production in larger-scale including fish culture, pond management, harvesting, processing, packaging, transport, and storage, as well as the economic aspects of aquaculture and fishery.
3. Understanding theoretical and practical knowledge on various traditional and modern tools and techniques used in aquaculture and fishery.
4. Understand the Pearl oyster culture and Prawn farming, its varieties and economic importance of aquarium fishes to society, and its aesthetic values.
5. Understand the aquarium fishes, its varieties and economic importance of aquarium fishes to society, and its aesthetic values.
6. Know the current status of aquaculture and fishery in India and specifically in Jharkhand, including financial support mechanisms provided by governments and various NGOs for aquaculture initiatives.

Unit	Topic	No. of Lectures
Unit 1	Pisciculture	
1.1	General character of fishes, Fishing methods: Capture Fisheries, Monoculture, Polyculture, Integrated fish farming	4
1.2	Fish seed production technology, Different stages of seed: Spawn, Fry and Fingerlings	3
1.3	Preparation and Management of Nursery and Rearing ponds, Transport of fish seeds and brood fishes, Hatchery and its management	4
1.4	Fish Disease, its control and management: Causative agents, symptoms and control of some infectious diseases of fish	2
Unit 2	Fishing Crafts, Gears and Post-harvest Technology in Pisciculture	
2.1	Classification and description of different type of fishing crafts in India	3
2.2	Fishing gear: Classification of fishing gear, Nets, meshes, hook and ropes	3
2.3	Post Harvest Technology: Principles and Importance of fish preservation	2
2.4	Methods of fish preservation: Icing, Freezing, Cold storage, Drying, Salting, Smoking, Canning and Fish Pickling.	3
Unit 3	Pearl Oyster culture and Prawn/Shrimp farming	
3.1	Basic concept of pearl culture, Pearl-producing mollusks, Pearl culture techniques, Economic importance of pearls	4
3.2	Basics of Prawn/Shrimp farming: Culture practices of <i>Penaeus monodon</i> , <i>Penaeus indicus</i> and <i>Metapenaeus dobsoni</i>	3
3.3	Pond preparation, stocking of Hatchery, Nursery, grow out ponds and harvesting of shrimp.	3
Unit 4	Ornamental Fish Production and Aquarium Management	
4.1	Ornamental/Aquarium Fishes: Common Species, Introduction to aquarium,	3
4.2	Design and construction of aquaria, Aquarium accessories - Aerators, filters, lighting and heaters etc. Use of natural and artificial aquatic plants.	3
4.3	Aquarium Management: Setting up of aquarium – under gravel filter, pebbles, plants, drift wood and ornamental objects,	3
4.4	Commercial breeding and culture of ornamental fishes.	2
	Total Lecture	45

Books Recommended

1. Jayaram K.C(2010). Fish Taxonomy. NPH
2. Jayaram K.C(2010). Fishes of the Indian region. NPH
3. Khanna S.S.(214). Introduction to Fishes. Silver Line
4. ICAR. 2006. Hand Book of Fisheries and Aquaculture. ICAR.
5. Jhingran VG & Pullin RSV. 1985. Hatchery Manual for the Common, Chinese and Indian Major Carps. ICLARM, Philippines.
6. Jhingran VG. 1991. Fish and Fisheries of India. Hindustan Publisher.

Minor – 2B (Practical) (MN-2B-P) Aquaculture and Fishery**Demonstration /field visits /Laboratory work based on the above theory content.****FM = 25 [End Semester = 25] no Internal Examination**

Sl. No	Suggested Practical	Marks Distribution
1.	Identification of Major Carp	05
2.	Identification of different Fishing craft/Gears	02
3.	Spotting (4): Carp fish (1), Prawn/Shrimp (1) Pearl oyster (1) Ornamental fish (1)	4X2: 08
4.	Class record and/or Project Report	05
5.	Viva voce	05
	Total	25

Suggested Practical

- Key to identify different types of fishes, Types of fins and scales of fishes
- Field visit: Visit to nearby freshwater bodies, fish culture pond, Collection and identification of fishes.
- Common freshwater fishes: Rohu, Catla, Mrigal, Cat fishes,
- Pearl Oyester species of India: *Pinctada vulgaris*, *Pinctada marigaritifera*, *Pinctada chemnitzii*, etc.
- Prawn/Shrimp species of India: *Penaeus monodon*, *Penaeus indicus*, *Metapenaeus dobsoni* and *Macrobrachium rosenbergii*
- Aquarium Fishes: Goldfish, Live bearers, Gouramies, Barbs and Tetras, Angel fish
- Study on various fishing crafts, fish gears, and modern technology uses in fish culture.
- Fish Harvesting, packaging, transport and storage of fishes
- Study of various diseases & enemies of fishes.
- Project Report based on field visits and surveys of aquaculture pond and freshwater bodies.

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Binod Bihari Mahto Koyalanchal University, Dhanbad

Subject: Zoology

FYUGP _NEP2020 (from session 2023 onwards)

UG Syllabus

Minor from Vocational

Semester VI

Minor – 2C (MN-2C) Vermiculture and Vermicompost Technology

Credit – 4

Lectures – 60 Hours

FM = 75((No Internal Examination)+ 25 Skill test/Viva voce/Practical/Demonstration

Instructions:

- In all nine questions to be set there shall be two groups, i.e., A and B.
 - **Group A** is compulsory which will contain three questions.
 - Question no. 1 will be very short answer type/ Objective type consisting of five questions of **1 mark** each.
 - Question no. 2 & 3 will be of short answer type of **5 marks** each.
 - **Group B** will contain descriptive type, six questions* of **Fifteen marks** each, out of which any four to be answer.
- *Question no.9 will be short answer type. There will be four options of which any two to be answered carrying equal marks covering the whole syllabus.

Learning Outcomes:

After successfully completing this course, the students will be able to:

1. Understand vermiculture and vermicomposting, encompassing theoretical knowledge, practical applications, and economic considerations.
2. Understand the role of vermiculture and vermicomposting in maintaining soil structure and their contribution to the four R's of Recycling (Reduce, Reuse, Recycle, Restore).
3. Explain the matter and humus cycle, including the transformation process of organic matter facilitated by earthworm activity.
4. Describe the ecology, anatomy, physiology, and reproductive characteristics of important vermicomposting Earthworms.
5. Learn the small-scale earthworm farming and commercial aspects of larger-scale vermicomposting, including vermiculture, harvesting, processing, packaging, transport, and storage, as well as the economic aspects of vermiculture and vermicomposting.
6. Understand the composition of vermicompost, and exploring its physicochemical features to evaluate its suitability for agricultural and waste management purposes.
7. Know the current status of vermicomposting in India and Jharkhand, including financial support mechanisms provided by governments and NGOs for vermiculture initiatives.
8. Assess the impact of pests and microbes on vermiculture operations, and implementing effective control measures to mitigate their impact and ensure productivity.

Unit	Topic	Total no. of Lectures
Unit 1:	Introduction to Vermiculture and Vermicomposting	
1.1	Vermiculture: Definition, meaning, difference between vermiculture and vermicomposting, history, scope, economic importance, their value in maintenance of soil structure, role as four R's of Recycling -Reduce, Reuse, Recycle, Restore	3
1.2	Types of Earthworms: Epigeic, Endogeic and Anecic earthworms. phytophagous and geophagous earthworm.	1
1.3	Definition, Habitat and Ecology of Native and Exotic species of Vermicomposting Earthworms (Native Indian earthworms. <i>Perionyx excavatus</i> , <i>Perionyx ceylanensis</i> , European earthworms. <i>Eisenia fetida</i> , <i>Eisenia andrei</i> , South African earthworms. <i>Eudrilus eugeniae</i>); Selective features of earthworm species for vermicomposting.	4
1.4	The matter and humus cycle. Transformation process of organic matter.	3
Unit 2:	Earthworm Biology	
2.1	<i>Eisenia fetida</i> and <i>Eudrilus eugeniae</i> : Taxonomy, Anatomy, Physiology and Reproduction	6
2.2	Vital cycle of <i>Eisenia fetida</i> and <i>Eudrilus eugeniae</i> : alimentation, fecundity, annual reproducer potential and limit factors (gases, diet, humidity, temperature, PH, light, and climatic factors).	5
Unit 3:	Vermicompost Technology	
3.1	Principle of vermicomposting; Components of the vermicomposting System; Methods of vermicomposting (Low-cost floor beds and Tank system); Management during vermicomposting.	3
3.2	Small Scale Earthworm farming and composting for home gardens	3
3.3	Commercial larger scale vermicomposting: Earthworm farming (vermiculture), vermicomposting extraction (harvesting) and processing. Packaging, transport and storage of Vermicompost.	6
Unit 4:	Economic Aspects of Vermiculture and Vermicomposting	
4.1	Vermicompost: Definition, composition and physicochemical features. Role of earthworm and vermicompost in agriculture and waste management. Vermiwash composition and its use in agriculture.	4
4.2	Status of Vermiculture and Vermicomposting in India and Jharkhand. Marketing of vermicomposting products and financial support by governments and NGOs for vermiculture.	4
4.3	Influence of pests, microbes and other enemies on vermiculture, measures to control them.	3

Books Recommended

1. Chauhan, A. (2012) Vermitechnology, Vermiculture, Vermicompost and Earthworms: Vermiculture, Vermicomposting, Vermitechnology and Microbes, Lambert Academic Publishing, Germany.
2. Christy, M. V. (2008) Vermitechnology, 1st edition, MJP Publishers.

3. Dash, M.C., B.K. Senapati, P.C. Mishra (1980) "Vermis and Vermicomposting" Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, Jyoti Vihar, Orissa.
4. Ismail, S.A. (1997). Vermicology - The Biology of Earthworms. OrientLongman, 92 pages.
5. Kumar, A. (2005) "Vermis and Vermitechnology", APH Publishing.
6. Lee, K.E. (1985) "Earthworms: Their ecology and Relationship with Soils and Land Use" Academic Press, Sydney.
7. Lekshmy, M. S., Santhi R. (2012) "Vermitechnology", Sara Publications, New Delhi, India.
8. National Institute of Industrial Research, (2010) "The Complete Technology Book on Vermiculture and Vermicompost", National Institute of Industrial Research, Delhi-7, India.
9. Satchel, J.E. (1983) "Earthworm Ecology" Chapman Hall, London.

Minor – 2C (MN-2C-P)- Vermiculture and Vermicompost Technology
Demonstration /field visits /Laboratory work based on the above theory content.
FM = 25 [End Semester = 25] no Internal Examination

Sl. No	Practical	Marks Distribution
1.	Comments on earthworm life cycle/Life stages	05
2.	Identify different types of earthworms based on key	05
3.	Spotting (common species for vermiculture, Vermi pests) (2)	05
4.	Class record and/or Project Report	05
5.	Viva voce	05
Total		25

Suggested Practical
Vermiculture and Vermicompost Technology

1. Key to identify different types of earthworms.
2. Field Work: Collection of native earthworms & their identification.
3. Study of Systematic position, habits, and habitat & External characters of *Eisenia fetida*.
4. Study of Life stages & development of *Eisenia fetida* and *Eudrilus eugeniae*.
5. Study of Vermiculture, Vermiwash & Vermicompost equipment and devices.
6. Harvesting, packaging, transport and storage of Vermicompost and separation of life stages
7. Study of verms diseases & enemies.
8. Project Report

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Subject: Zoology

FYUGP_NEP2020 (from session 2023 onwards)

UG Syllabus

Minor from Vocational

Semester VIII

Minor – 2D (MN-2D) Agrochemical and Pest Management

Credit – 4

Lectures – 60 Hours

FM = 75 (No Internal Examination)+ 25 Skill test/Viva Voce/Practical/Demonstration

Instructions:

- In all nine questions to be set there shall be two groups, i.e., A and B.
- **Group A** is compulsory which will contain three questions.
- Question no. **1** will be very short answer type/ Objective type consisting of five questions of **1 mark** each.
- Question no. **2 & 3** will be of short answer type of **5 marks** each.
- **Group B** will contain descriptive type, six questions* of **Fifteen marks** each, out of which any four to be answer.

*Question no.9 will be short answer type. There will be four options of which any two to be answered carrying equal marks covering the whole syllabus.

Learning outcomes:

After successfully completing the course, the students will be able to:

- Gain knowledge and expertise on the agrochemicals and their modes of action and their fates in the Agro-ecosystem.
- Have the knowledge of pesticides families and be able to differentiate among families based on their specific modes of activity.
- Aware of the laws and regulations governing the proper use of pesticides.
- Develop appropriate pesticide management strategies by evaluating specific pest type.
- Understand the factors involved in calibrating equipment for pesticide applications.
- Estimate the potential hazards to humans, wildlife, and the environment.

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Unit	Topic	Total no. of Lectures
Unit 1:	Fundamentals of Pest Management	
1.1	Definition of pest, Types of pests according to nature of damage.	4
1.2	Plant pests: Weeds, Bacteria, Fungi, Viruses, Nematodes, Molluscs, Arthropods, etc.	3
1.3	Integrated Pest Management 1.4.1: Cultural 1.4.2: Biological 1.4.3: Chemical 1.4.4: Genetic control	4
Unit 2:	Agrochemicals nutrients for increasing the health of plants	
2.1	Manures: Types, composition and value, sources of manures	1
2.2	Compost: Different composting technologies, mechanical compost plant, vermicomposting	3
2.3	Green manures: oil cakes, sewage sludge-biogas plant slurry.	1
2.4	Chemical fertilizers: N- fertilizers: manufacturing of ammonium sulphate, urea. P-fertilizers: processing rock phosphate, bone meal preparation K- fertilizers: potassium chloride, potassium sulphate <i>Azotobacter</i>	4
2.5	Biofertilizers: <i>Rhizobium</i> , <i>Azotobacter</i> , <i>Azolla</i> , <i>Blue Green Algae</i> , VAM.	2
Unit 3:	Agrochemicals for pest management	
3.1	Conventional chemical/pesticides based on target species: Acaricides, Fungicides, Rodenticides, Nematicides, Molluscicides.	4
3.2	Fumigants and Repellents: Organophosphates, Carbamates. Structure, chemical name, physical and chemical properties; Mode of action, Toxicity	4
3.3	Application of pesticides, devices used; dose estimation for field application.	3
Unit 4:	Botanicals and other biopesticides	
4.1	Basics of potential pesticidal plants, plant extract and its role in pest control.	4
4.2	Growth inhibitors or physiological antagonists, chemo-sterilant; pheromones and attractants; Insect growth regulators, juvenile hormones, moulting hormones.	4
4.3	Chitin synthesis inhibitors, Moulting inhibitors	2

4.4	BT methodology, genetically modified and transgenic plants.	2
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Books Recommended

1. Pradhan. S. (1969). *Insect Pests of Crops*. National Book Trust, India Book House.
2. Hill, D.S. (1983) *Agricultural insect pests of the tropics and their control*- Cambridge Univ. Press.
3. Atwal, A.S. (1993) *Agricultural pests of India and South East Asia*. Kalyani Pub., New Delhi.
4. Dent, D. (2000) *Insect pest management* (2nd edition)) CAB International.
5. Roberts F. Norris, Edward P. Caswell-Chen and Marcos Kogan, *Concepts of Integrated Pest Management*, Prentice Hall of India.
6. De Bach, P. (1964) *Biological Control of insect Pests and Weeds*, Chapman & Hall, New York.
7. Koul, O. and Dhaliwal, G.S. (2003) *Phytochemical Bio-pesticides*, Harwood Academic Publishers, Amsterdam.
8. Dennis, S. Hill. (2005) *Agricultural Insect Pests of the tropics and their management*, Cambridge University press.
9. Pedigo, L.P. (2002) *Entomology and Pest management*, Prentice Hall, N. Delhi.

Minor – 2D (Practical) (MN-2D-P) --Agrochemical and Pest Management

Demonstration /field visits /Laboratory work based on the above theory content.

FM = 25 [End Semester = 25] no Internal Examination

Sl. No	Practical	Marks Distribution
1.	Collection, preservation and identification of animal pests	05
2.	Study of pest of paddy/sugarcane/Vegetable	05
3.	Spotting (2)	05
4.	Class record and/or Project Report	05
5.	Viva voce	05
Total		25

Suggested Practical

1. Collection Preservation and identification of animal pest.
2. Study of pest of paddy (*Scirpophaga incertulas*, *Leptocorisa acuta*), sugarcane (*Ceratovacuma lanigera*, *Pyrilla perpusilla*) and vegetables (*Bemisia tabaci*, *Spodoptera litura*).
3. Study of instruments used in Pest Management: Sprayer, Net, Sticky trap, Fogging instrument
4. Preparation of extract from Neem and *Lantana camara* and its application as biopesticide.
5. Trip to any agricultural field of your locality.