

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

Three Years- Six Semesters Bachelor's Degree Programme

3 Years B.Sc. /4 Year B.Sc. (Hons) & 4 Year B.Sc. (Hons with Research) Programme



Faculty of

Science and Technology

(Science Group)

Subject: APICULTURE

(Semesters V and VI)

Effective from Academic Year 2026-27

(As per Uniform NEP 2020)

Contents

• Examination, Evaluation and Assessment Scheme.....	03
• THIRD YEAR: Level 5.5 - SEMESTER – V (T & L Credit Scheme)	04
1. Apiculture MJ Theory 7	05
2. Apiculture Mj Theory 8	08
3. Apiculture MJ Theory 9	11
4. Apiculture MJ Lab/ Practical	13
5. Apiculture MJ Elective Theory 1	17
6. Apiculture MJ Elective Lab/ Practical	20
7. Apiculture MJ Elective Theory 2	22
8. Apiculture MJ Elective Lab/ Practical	25
9. Apiculture MN Theory	29
10. Apiculture MN Lab/ Practical	32
11. Apiculture VSC- Lab/ Practical	35
12. Apiculture SEC- Lab/ Practical.	37
13. Apiculture FP/CES-3 Project	39
• THIRD YEAR: Level 5.5 - SEMESTER – VI (T & L Credit Scheme)	42
1. Apiculture MJ Theory 10	43
2. Apiculture MJ Theory 11	46
3. Apiculture MJ Theory 12	49
4. Apiculture MJ Lab/ Practical	53
5. Apiculture MJ Elective Theory	57
6. Apiculture MJ Elective Lab/ Practical	60
7. Apiculture MJ Elective Theory.....	63
8. Apiculture MJ Elective Lab/ Practical	67
9. Apiculture MN Theory	70
10. Apiculture MN Lab/ Practical	73
11. Apiculture VSC-5 Lab/ Practical	75
12. E Apiculture Internship/ OJT	76

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

FACULTY: Science and Technology

Subject: Apiculture

Teaching and Learning Scheme for the Degree of Bachelor of Science (B.Sc.)

Three Years / Four Years - (Six/ Eight Semesters) Bachelor Degree Programme

Examination, Evaluation and Assessment Scheme

Vertical No.	The Vertical	Mode of Examination & Evaluation Assessment	Theory					Theory (Total)		Practical						Practical (Total)	
			External			Internal				External			Internal				
			Max Marks	Min Marks	Duration (Hrs.)	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Duration (Hrs.)	Max Marks	Min Marks	Max Marks	Min Marks	
A	Major	External & Internal	30	9	2	20	6	50	20	25	10	4	25	10	50	20	
	Elective		30	9	2	20	6	50	20	25	10	4	25	10	50	20	
B	Minor		30	9	2	20	6	50	20	25	10	4	25	10	50	20	
C	Generic/ Open Elective		--	--	--	--	--	--	--	--	--	--	--	--	--	--	
D	VSC	Internal	---	---						--	--		50	20	50	20	
	SEC	Internal	---	---						--	--		50	20	50	20	
F	Internship/ Apprenticeship	Internal	Assessment of these verticals shall be based on various activities/practices. It shall be evaluated by giving maximum marks of 50 per 2 Credit Course with separate activity weightages/levels. A detailed SOP for this assessment process shall be prescribed separately.														
	FP/CES																
	CC																

Internal Assessment for Theory/Practical/Laboratory:

All the internal assessments should be conducted on the basis of Continuous Assessment Tests (CAT).

Continuous Assessment Tests (CAT):

For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under

- Three CAT each of 10 Marks (Theory) and 10 Marks (Practical).
 - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
 - Second on completion of 50% Syllabus of the course or on completion of 50 teaching days,
 - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days. .
- Each concurrent assessment (CAT-I, II & V) will be mapped to relevant Course Learning Outcome.
- Total Performance in CAT (i.e.40 %) shall be based on the best two out of three in CAT examinations
- Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, seminar, case study, field work, mini project work, quiz or any innovative method, which may be deemed to be appropriate for assessing the relevant course outcome.

Evaluation and Assessment for FP/CES:

- Project Report: The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks)
- Oral Presentation: The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks)
- Faculty Evaluation: The faculty mentor will assess the student's performance throughout the project. (20 Marks)
- Total 50 Marks**

Note: The external assessments of theory courses will be conducted in accordance with the guidelines issued by the SGBA University.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
FACULTY: Science and Technology
Subject: APICULTURE
Teaching and Learning Scheme: for the Degree of Bachelor of Apiculture (B.Sc.)
Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme

THIRD YEAR: Level 5.5 - SEMESTER – V (T & L Credit Scheme)

Mode of Teaching	Ver. No	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major	Theory-7	100218	Casts Of Honeybees and their role.	2	2	16
			Theory-8	100219	Major Theory-8: Communication and Behaviour in Honeybees	2	2	
			Theory-9	100220	Major Theory -9: Honey Bee Ecology	2	2	
			Lab/Practical-15	100221	Practical based on Major-7,8 &9	2	4	
		Major (Elective)	Theory-1	100222	<i>Apis dorsata</i> (Rock Bee) – Ecology and Behaviour	2	2	
			Lab/Practical-1	100223	Practical based on Elective-1	2	4	
			Theory-2	100224	Fundamentals of Honey Bee Product Processing and Preservation	2	2	
			Lab/Practical-17	100225	Practical based on Elective-2	2	4	
	b.	Minor	Theory-5	100226	Bee-Pollination Management	2	2	6
			Lab/Practical-18	100227	Practical based on Minor	2	4	
	c.	Generic/Open Elective	-	-	-	-	-	-
	d.	VSC	Lab/Practical-19	100276	VSC-: Bee health monitoring and bee enemies.	2	4	8
		SEC	-	100277	SEC: Hands-on Training in Beekeeping Equipment and Hive Product Extraction	2	4	
	e.	VEC	-	-	-	-	-	0
	f.	FP/CES	Project	100228	Field Project / Community Engagement Services in Apiculture:	2	4	4
		CC	-	-	-	-	-	-
		AI						
		TOTAL				22	34	34

Sant Gadge Baba Amravati University, Amravati
FACULTY: SCIENCE AND TECHNOLOGY
Teaching and Learning Scheme: for the Degree of Bachelor of **APICULTURE**
Syllabus for Courses B.Sc. III SEMESTER-V

Major Theory-7: Casts of Honeybees and their role .

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration Hrs	Max. Marks
5.5	100218	V	Major Theory-7: Casts of Honeybees and their role .	02	30	02	Ext -30 Int.-20

Course Objectives	1. To know casts and their numbers in honey bee colony. 2. To understand stages in lifecycle of honey bee. 3. Understand the social organization and caste system of honeybees. 4. Identify the different castes of honeybees — queen, workers, and drones — based on their morphology and behaviour. 5. Explain the structure, development, and life cycle of each caste in a honeybee colony. 6. Describe the specific roles and responsibilities of worker bees in colony maintenance, foraging, brood care, and defence.			
Course Outcome	After the completion of this course, student will be able to- CO-1 Apply knowledge to Identify castes in honey bee colony. CO-2 Familiar with stages in life cycle of honey bee. CO-3 Describe characteristics and function of each caste in honey bee colony. CO-4 Discuss the function of drones in mating biology and genetic diversity maintenance of bee populations. CO-5 Interpret the honey bee colony as a superorganism, explaining how cooperation among castes maintains colony homeostasis.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Development of Honey Bee	8	8	• Lecture Method • Demonstration Method • Experiential Learning • Laboratory Teaching • Activity-Based Learning • Collaborative Learning • ICT-Enabled Teaching • Problem-Solving Approach • Project-Based Learning • Field-Based
	1.1 Stages of Life Cycle			
	1.2 Egg laying and its stage			
	1.3 Larval stage			
	1.4 Pupal stage			
	1.5 Adult stage			
Unit-II	Development of Queen	7	7	
	2.1 Queen: development time for queen, queen cell			
	2.2 Queen Characteristics			
	2.3 Functions of Queen			
	2.4 Queen mating and Egg laying			
Unit-III	Development of worker	8	8	
	3.1- Development time for workers cells.			
	3.2- Characteristics of worker bee.			
	3.3- Functions of worker			
	3.4- Laying workers			
Unit-IV	Development of drone	7	7	
	4.1 Drone egg and drone cell			
	4.2 Time and its characteristics			
	4.3 Characteristics of drones			
	4.4 Functions of drones.			

1. References:

1. **Graham, J. M.** (2015). *The Hive and the Honey Bee*. Dadant & Sons, USA.
2. **Winston, M. L.** (1987). *The Biology of the Honey Bee*. Harvard University Press.
3. **Crane, E.** (1990). *Bees and Beekeeping: Science, Practice and World Resources*. Heinemann Newnes.
4. **Morse, R. A. and Hooper, T.** (1985). *The Illustrated Encyclopedia of Beekeeping*. Blandford Press.
5. **Free, J. B.** (1980). *A Handbook of Beekeeping*. IBH Publishing Co., New Delhi.
6. **Seeley, T. D.** (1995). *The Wisdom of the Hive: The Social Physiology of Honey Bee Colonies*. Harvard University Press.
7. **Singh, S.** (1962). *Beekeeping in India*. Indian Council of Agricultural Research (ICAR), New Delhi.
8. **Prosopis, A. R. and Shukla, G. S.** (1995). *Economic Zoology*. Rastogi Publications, Meerut.
9. **Mishra, R. C.** (1995). *Honey Bees and Their Management in India*. ICAR Publications.
10. **Dhaliwal, G. S. and Sharma, P. L.** (2003). *Entomology and Apiculture*. Kalyani Publishers.
11. **Patti, J.** (2008). *Practical Manual of Beekeeping*. Agrobios Publications.
12. **FAO.** *Beekeeping and Sustainable Livelihoods*. Food and Agriculture Organization Publications.
13. **NCERT Biology Texts** – Chapters related to social insects and apiculture.
14. **ICAR E-Course on Apiculture** – Study material on honeybee castes, behavior, and colony management.
15. **National Bee Board (India) Manuals** – Training manuals on honeybee biology and beekeeping practices.

Model Questions

Short Type:

1. What is laying worker?
2. What are the characteristics of worker egg?
3. Give the characteristics of queen cell.
4. Where did the queen and drone mating take place?
5. Which caste of bee lays eggs in honey bee colony?
6. How many stages in life cycle of honey bee have?
7. How many days required to take birth by queen bee?
8. Which type of shape of egg of honey bee have?

Long Type: (Minimum 4):

1. Discuss stages and time required for to complete life cycle of honey bee for each caste.
2. Discuss laying workers and when such condition get existed.
3. Explain egg laying and mating process in queen bee in a colony.
4. Discuss differentiation in eggs of honey bees.

MCQ (Minimum 8):

1. Only the function of drone bee is-----
A- egg laying, B- mating, C- guarding, D- foraging.
2. After queen -----bee caste lays egg in colony.
A- worker, B-drone, C- wasp, D- none.
3. Mating of queen and drone takes place -----.
A- in hive, B- on land, C- atmosphere, D- in water.
4. The biggest cell in bee colony is of -----
A- Drone, B-queen, C- worker, D- wasp.
5. -----days required to take birth by queen bee.
A- 12, B-21, C-18, D-14.
6. The queen cell on brood chamber is located at ----- of brood comb.
A- bottom, B-top, C-side, D- centre.
7. At favourable conditions, queen bee lays ----- egg per day.
A- 1200- 2000, B- 500-1000, C- 3000-4000, D- 5000.
8. The smallest cell of birth of bee caste is of -----bee.
A-queen, B-worker, C- drone D- wasp.

Rubric for Internal Assessment for Theory Paper

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- SEMESTER – V (NEP)		
Code:100218	Major Theory-7 : Casts Of Honeybees and their role	Max Marks: 20
Sr. No.	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05

Major Theory-8: Communication and Behaviour in Honeybees

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100219	V	Major Theory-8: Communication and Behaviour in Honeybees	02	30	02	Ext-30 Int-20

Course Objectives	- To understand social, defence, foraging and reproductive behaviour among casts of honey bee in a colony. - To study the different dances performed by worker bees to locate food. - To know use of Pheromones used by bees for communication. - To differentiate behaviour among different casts in honey bee. - To understand different mode of communication among the casts.			
Course Outcome	After completing this course, students will be able to: CO-1 Understand the basic behavioural patterns of honeybees and their importance in colony organization. CO-2 Explain different modes of communication in honeybees, including dance language, pheromones, and sound signals. CO-3 Describe the foraging behaviour and navigation mechanisms used by honeybees in locating food sources. CO-4 Analyse the defensive behaviour of honeybee colonies and the role of worker bees in colony protection. CO-5 Understand social interactions and division of labour among members of a honeybee colony. CO-6 Study swarming, mating, brood care, and other important behavioural activities of honeybees. CO-7 Evaluate the influence of environmental factors on honeybee behaviour and colony performance. CO-8 Develop awareness about the significance of honeybee behaviour in apiculture, crop pollination, and ecosystem sustainability.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Introduction to Honeybee Behaviour 1.1. Meaning and scope of behavioural studies in honeybees. 1.2. Social organization of honeybee colony. 1.3. Behavioural characteristics of queen, workers, and drones. 1.4. Division of labour and age polytheism in worker bees.	8	8	• Lecture Method • Demonstration Method ☐ Experiential Learning ☐ Laboratory Teaching ☐ Activity-Based Learning ☐ Collaborative Learning ☐ ICT-Enabled Teaching ☐ Problem-Solving Approach ☐ Project-Based Learning
Unit-II	Communication in Honeybees 2.1. Importance of communication in social insects. 2.2. Dance language: round dance and waggle dance. 2.3. Role of pheromones in colony coordination. 2.4. Tactile, chemical, and sound communication. 2.5. Orientation and recruitment behaviour.	7	7	

Unit-III	Foraging and Navigational Behaviour 3.1. Foraging patterns and food collection behaviour. 3.2. Nectar and pollen gathering activities. 3.3. Navigation and homing behaviour. 3.4. Influence of environmental factors on foraging. 3.5. Learning and memory in honeybees.	8	8	☐ Field-Based
Unit-IV	Defensive and Reproductive social behaviour of Honeybees 4.1. Defensive behaviour of Honeybees 4.2. Alarm pheromones and stinging behaviour., Guard bees and nest protection 4.3. Swarming behaviour and colony reproduction 4.4. Mating behaviour of queen and drones 4.5. Brood care and nursing behaviour	7	7	

References:

1. **Seeley, T. D.** (1995). *The Wisdom of the Hive: The Social Physiology of Honey Bee Colonies*. Harvard University Press.
2. **Winston, M. L.** (1987). *The Biology of the Honey Bee*. Harvard University Press.
3. **Frisch, K. von** (1974). *Decoding the Language of the Bee*. Harvard University Press.
4. **Frisch, K. von** (1967). *The Dance Language and Orientation of Bees*. Harvard University Press.
5. **Free, J. B.** (1987). *Pheromones of Social Bees*. Chapman and Hall, London.
6. **Free, J. B.** (1980). *A Handbook of Beekeeping*. IBH Publishing Co., New Delhi.
7. **Crane, E.** (1990). *Bees and Beekeeping: Science, Practice and World Resources*. Heinemann Newnes.
8. **Seeley, T. D.** (2010). *Honeybee Democracy*. Princeton University Press.
9. **Morse, R. A. and Hooper, T.** (1985). *The Illustrated Encyclopedia of Beekeeping*. Blandford Press.
10. **Graham, J. M.** (2015). *The Hive and the Honey Bee*. Dadant & Sons, USA.
11. **Breed, M. D., Guzmán-Novoa, E., and Hunt, G. J.** (2019). *Honey Bee Biology and Beekeeping*. Academic Press.
12. **Seeley, T. D.** (1985). *Honeybee Ecology: A Study of Adaptation in Social Life*. Princeton University Press.
13. **Mishra, R. C.** (1995). *Honey Bees and Their Management in India*. ICAR Publications.
14. **Dhaliwal, G. S. and Sharma, P. L.** (2003). *Entomology and Apiculture*. Kalyani Publishers.
15. **National Bee Board (India)** – Training manuals and extension literature on honeybee behavior, communication, swarming, and foraging.

Model Questions

Short Type: (Minimum 8):

1. What is meant by honeybee behaviour?
2. Name the different castes found in a honeybee colony.
3. What is division of labour in honeybees?
4. Define age polytheism in worker bees.
5. What is the waggle dance?
6. What information is conveyed through the round dance?
7. Who discovered the dance language of honeybees?
8. What are pheromones?

Long Type: (Minimum 4):

1. Discuss the communication system in honeybees with special reference to waggle dance and round dance.
2. Describe the division of labour among worker bees in relation to age polytheism.
3. Explain the foraging behaviour of honeybees and the factors affecting food collection activities.
4. Write a detailed note on pheromonal communication in honeybees and its significance in colony organization.
5. Describe the defence mechanisms of honeybees against predators and intruders.
6. Explain the role of guard bees and alarm pheromones in colony defence.
7. Discuss the navigation and orientation behaviour of honeybees.

8. Explain swarming behaviour in honeybees and its importance in colony reproduction.
9. Describe brood care and nursing behaviour in honeybee colonies.
MCQ:
1. The scientific study of honeybee behavior is known as: a) Apiculture, b) Ethology, c) Sericulture, d) Entomophagy, Answer: b) Ethology
2. Which caste is primarily responsible for foraging in a honeybee colony? a) Queen, b) Drone, c) Worker, d) Larva, Answer: c) Worker
3. The dance performed by bees to indicate a nearby food source is called: a) Tremble dance, b) Waggle dance, c) Round dance, d) Spiral dance, Answer: c) Round dance
4. Who discovered the dance language of honeybees?, a) Karl von Frisch, b) Charles Darwin, c) Aristotle, d) Watson, Answer: a) Karl von Frisch
5. Honeybees communicate mainly through: a) Sound only, b) Dance and pheromones, c) Light signals, d) Touch only, Answer: b) Dance and pheromones
6. The waggle dance indicates: a) Presence of enemies, b) Direction and distance of food, c) Mating behavior, d) Queen replacement Answer: b) Direction and distance of food
7. The chemical substances used for communication among bees are called: a) Hormones, b) Enzymes, c) Pheromones, d) Proteins, Answer: c) Pheromones
8 Which bee caste produces eggs in the colony? a) Worker, b) Drone, c) Queen, d) Guard bee, Answer: c) Queen
9. The male honeybee is known as: a) Worker, b) Drone, c) Scout, d) Nurse bee, Answer: b) Drone
10. The primary function of drones is: a) Foraging, b) Defence, c) Mating with the queen, d) Hive cleaning Answer: c) Mating with the queen,

Rubric for Internal Assessment for Major Theory Paper

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- SEMESTER – V (NEP)		
Code:100219	Major Theory-8 Communication and Behaviour in Honeybees.	Max Marks: 20
Sr. No.	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05

Major Theory -9: Honey Bee Ecology

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100220	V	Major Theory -9: Honey Bee Ecology	02	30	02	Ext-30 Int-20

Course Objectives	1. To understand ecological relationships of honey bees 2. To study environmental factors affecting honey bee populations 3. To examine pollination ecology and ecosystem services 4. To promote conservation and sustainable management of honey bees			
Course Outcome	After the completion of course , student will be able to- 1. Explain ecological adaptations and behaviour of honey bees. 2. Describe the role of honey bees in pollination and ecosystems. 3. Analyze environmental impacts on honey bee health and survival. 4. Apply sustainable practices for conservation of honey bees and pollinators.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Introduction to Honey Bee Ecology 1.1-Concept and scope of honey bee ecology. 1.2-Honey bee species and ecological adaptations. 1.3-Habitat requirements of honey bees. 1.4-Interaction of honey bees with the environment and role of honey bees in ecosystem functioning	8	8	• Lecture Method • Demonstration Method ☐ Experiential Learning ☐ Laboratory Teaching ☐ Activity-Based Learning ☐ Collaborative Learning ☐ ICT-Enabled Teaching ☐ Problem-Solving Approach ☐ Project-Based Learning ☐ Field-Based
Unit-II	Honey Bees and Plant Interactions 2.1- Bee-flower relationships, Nectar and pollen sources. 2.2-Foraging behaviour of honey bees. 2.3-Floral calendar and seasonal availability of resources. 2.4-Importance of honey bees in biodiversity conservation.	7	7	
Unit-III	Environmental Factors Affecting Honey Bees 3.1-Influence of temperature, humidity, rainfall, and light. 3.2- Climate change and honey bee populations. 3.3- Effects of pesticides and agrochemicals. 3.4- Habitat loss and fragmentation and Stress factors affecting colony survival Adaptation and resilience of honey bees	8	8	

Unit-IV	Conservation and Sustainable Management of Honey Bees: 4.1-Conservation of wild and managed bee populations. 4.2-Sustainable apiculture practices and sustainable agriculture. 4.3- Integrated pollinator management. 4.4- Honey bees as bioindicators of environmental quality and Community participation in bee conservation.	7	7	
References: 1. The Biology of the Honey Bee 2. Honeybee Biology and Beekeeping 3. The Hive and the Honey Bee 4. ABC and XYZ of Bee Culture 5. Bees and Beekeeping: Science, Practice and World Resources 6. Honey Bee Ecology 7. Pollination and Floral Ecology 8. Insect Pollination of Cultivated Crop Plants 9. Social Insects 10. The Buzz about Bees: Biology of a Superorganism E-Contents / Digital Resources / Web Links 1. Food and Agriculture Organization (FAO) – Apiculture Resources 2. National Bee Board, India 3. Khadi and Village Industries Commission (KVIC) – Beekeeping Programs 4. ICAR – Indian Council of Agricultural Research 5. National Centre for Integrated Pest Management 6. Bee Informed Partnership 7. Pollinator Partnership 8. Apimondia – International Federation of Beekeepers’ Associations 9. University of Florida Honey Bee Research and Extension Lab 10. The British Beekeepers Association				
Short Questions: 1. Define honey bee ecology. 2. What is pollination? 3. Name any two species of honey bees. 4. What is a floral calendar? 5. Define foraging behaviour in honey bees. 6. What are the major environmental factors affecting honey bees? 7. What is the ecological role of honey bees? 8. Define sustainable apiculture.				
Long Type: 1. Explain the ecological importance of honey bees in agriculture and biodiversity conservation. 2. Describe the relationship between honey bees and flowering plants with suitable examples. 3. Discuss the environmental factors affecting honey bee populations and colony health. 4. Explain sustainable honey bee management and conservation practices.				
MCQ: 1. Honey bees mainly help in: a) Soil erosion, b) Pollination, c) Water purification, d) Nitrogen fixation 2. Which of the following is the scientific name of Indian honey bee? a) <i>Apis mellifera</i>, b) <i>Apis dorsata</i>, c) <i>Apis cerana indica</i>, d) <i>Apis florea</i> 3. Nectar collected by honey bees is converted into: a) Wax, b) Honey, c) Royal jelly, d) Propolis				

4. The movement of bees from flower to flower helps in:
a) Seed destruction, b) Pollination, c) Soil formation, d) Nitrogen fixation
5. Which environmental factor greatly affects bee activity?
a) Temperature b) Humidity, c) Rainfall, d) All of the above
6. Excessive use of pesticides can:
a) Improve bee health, b) Increase pollination, c) Harm honey bees, d) Increase honey quality
7. Honey bees are considered as:
a) Predators, b) Pollinators, c) Parasites, d) Scavengers.

Rubric for Internal Assessment for Theory Paper

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- SEMESTER – V (NEP)		
Code:100220	Major Theory-9: Honey Bee Ecology	Max Marks: 20
Sr. No.	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05
5	Overall Performance	05

Practical/ Lab Based on Major theory-7,8 & 9

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100221	V	Practical/ Lab Based on Major theory-7,8 & 9	02	60	04	Ext.25+ Int. 25

Course Objectives	1. To identify different castes of honeybees and study their morphological characteristics. 2. To understand the division of labour and functional roles of queen, worker, and drone bees in a colony. 3. To observe and analyze the communication methods of honeybees such as waggle dance, round dance, and pheromonal communication. 4. To study behavioural patterns of honeybees including foraging, defence, swarming, and hygienic behaviour. 5. To examine the relationship between honeybees and flowering plants in pollination ecology. 6. To investigate the ecological importance of honeybees in maintaining biodiversity and ecosystem stability. 7. To develop practical skills in handling bee colonies and using basic apicultural equipment. 8. To conduct field observations and record behavioural and ecological data scientifically. 9. To promote awareness regarding conservation of honeybees and sustainable beekeeping practices. 10. To enhance analytical and observational skills through laboratory and field-based experiments.
Course Outcome	After successful completion of the exercise/practical course, students will be able to: CO1-Identify and differentiate the various castes of honeybees based on morphology and functions within the colony. CO2-Explain the social organization and division of labour among queen, worker, and drone bees. CO3-Demonstrate understanding of honeybee communication systems including dance language and chemical communication. CO4-Observe and interpret major behavioural activities of honeybees such as foraging, swarming, nursing, and defensive behaviour. CO5-Assess the ecological role of honeybees in pollination and biodiversity conservation. CO6-Perform basic apicultural practices and safely handle bee colonies and beekeeping tools. CO7-Collect, analyze, and present field and laboratory data related to honeybee ecology and behaviour. CO8-Develop scientific attitude and environmental awareness regarding sustainable honeybee management and conservation practices.
List of Experiment/ Exercise	
A--Casts Of Honeybees and their role: 1. Identification and comparative study of queen, worker, and drone honey bees. 2. Observation of morphological differences among honey bee castes using hand lens or microscope. 3. Study of brood pattern and caste differentiation in hive frames. 4. Examination of pollen baskets, sting apparatus, and wax glands in worker bees. 5. Observation of egg-laying behaviour and role of queen in colony organization. 6. Preparation of labelled diagrams showing anatomical features of different honey bee castes. B- Communication and Behaviour in Honeybees 1. Observation and interpretation of waggle dance and round dance behaviour.	

2. Study of foraging behaviour and nectar collection activities of worker bees.
3. Observation of division of labour among honey bee castes within a colony.
4. Study of defensive behaviour and alarm response in honey bees.
5. Demonstration of pheromone-based communication in colony organization.
6. Field observation and recording of bee activity at different times of the day.

C- Honey Bee Ecology

1. Identification of local honey bee species
2. Observation of bee foraging behaviour
3. Study of nectar and pollen plants in local area
4. Preparation of floral calendar
5. Survey of pollinators in agricultural fields
6. Assessment of environmental factors affecting bee activity
7. Study of bee–flower interactions
8. Field visit to apiaries and pollination sites .

References/E-Contents / E-Books/Digital Resources / Web Links:

1. The Hive and the Honey Bee
2. Honeybee Biology and Beekeeping
3. The Biology of the Honey Bee
4. ABC and XYZ of Bee Culture
5. The Buzz about Bees: Biology of a Superorganism .
6. The Dancing Bees
7. The Wisdom of the Hive
8. Honeybee Democracy
9. The Biology of the Honey Bee Social Insects
10. Pollination and Floral Ecology
11. Bees and Beekeeping: Science, Practice and World Resources
12. Insect Pollination of Cultivated Crop Plants
13. Honey Bee Ecology
14. The Biology of the Honey Bee

E-Contents / Digital Resources / Web Links

1. [Food and Agriculture Organization \(FAO\) – Apiculture Resources](#)
2. [National Bee Board, India](#)
3. [Khadi and Village Industries Commission \(KVIC\) – Beekeeping Programs](#)
4. [ICAR – Indian Council of Agricultural Research](#)
5. [Apimondia – International Federation of Beekeepers’ Associations](#)

1. [University of Sussex – Honey Bee Behaviour Research](#)
2. [University of Florida Honey Bee Research and Extension Lab](#)
3. [Bee Informed Partnership](#)
4. [The British Beekeepers Association](#)

1. [Pollinator Partnership](#)
2. [Xerces Society for Invertebrate Conservation](#)
3. [United States Department of Agriculture – Pollinator Information](#)
4. [Centre for Pollination Studies, University of Calcutta](#)

Assessment Rubric for Internal Assessment for Major Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Apiculture) SEMESTER – V (NEP)		
Course Code:100221		Lab: Based on Major-7,8 and 9	Max Marks: 25
Sr. No.	Assessment Criteria	Marks	
1	Participation in activities	05	
2	Practical Book	05	
3	MCQ	10	
4	Attendance	05	

Assessment Rubric for External Assessment for Practical

E	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Assessment for Lab Work B.Sc.III ((Apiculture) SEMESTER – V (NEP)		
Course Code: 100221	Lab: Based on Major-7,8 and 9		Max Marks:25, Time: 4Hours
Sr. No.	Assessment Criteria	Marks	
1	Experiment on	07	
2	Experiment on	07	
3	Experiment on	07	
4	Viva-voce	04	

Major Elective-1: *Apis dorsata* (Rock Bee) – Ecology and Behaviour

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100222	V	Major Elective-1: <i>Apis dorsata</i> (Rock Bee) – Ecology and Behaviour	02	30	02	Ext-30 Int-20

Course Objectives	1. To provide detailed knowledge of the ecology and behavior of <i>Apis dorsata</i>. 2. To understand colony organization, nesting biology, and communication systems. 3. To examine migration, reproduction, and pollination ecology. 4. To analyze conservation challenges and sustainable management practices.			
Course Outcome	After successful completion of the course, students will be able to: CO-1: Explain the taxonomy, ecology, and social organization of <i>Apis dorsata</i>. CO-2: Describe nesting, foraging, migration, and communication behaviors. CO-3: Evaluate the ecological and agricultural importance of rock bees. CO-4: Identify threats affecting <i>Apis dorsata</i> populations and propose conservation measures. CO-5: Understand sustainable utilization and community-based conservation practices.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Introduction, Taxonomy, and Ecology of <i>Apis dorsata</i>: 1.1. Taxonomy and Systematics. 1.2. Origin and Geographical Distribution. 1.3. Morphology and Anatomy Habitat Ecology 1.4. Colony Organization and Social Structure 1.5. Ecological Importance	8	8	
Unit-II	Nesting Biology and Behavioural 2.1- Nesting Biology 2.2- Nest Site Selection 2.3- Foraging Ecology 2.4- Division of Labor 2.5- Defensive and Aggressive Behaviour, Seasonal and Environmental Behaviour	7	7	
Unit-III	Communication, Migration, and Reproductive Biology: 3.1 Communication Systems. 3.2 Swarming and Absconding. 3.3 Migration Ecology. 3.4 Reproductive Biology. 3.5 Colony Growth and Population Dynamics. 3.6 Adaptations to Environmental Stress.	8	8	

Unit-IV	Pollination Ecology, Threats, Conservation, and Sustainable Management: 4.1 Pollination Ecology. 4.2 Biodiversity and Ecosystem Services. 4.3 Threats to <i>Apis dorsata</i> . 4.4 Traditional Honey Hunting. 4.5 Conservation Strategies. 4.6 Community Participation and Future Prospects	7	7	
References				
Model Questions				
Short Type: 1. Define <i>Apis dorsata</i> and mention its common name. 2. What are the major characteristics of the nesting behavior of <i>Apis dorsata</i> ? 3. Write a short note on the ecological importance of rock bees. 4. What is meant by swarming behavior in <i>Apis dorsata</i> ? 5. Mention any four floral resources utilized by rock bees for foraging. 6. Explain the role of pheromones in communication among rock bees. 7. List the major threats affecting <i>Apis dorsata</i> populations. 8. What are the differences between migration and absconding in rock bees?				
Long Type: 1. Describe the taxonomy, morphology, colony organization, and ecological significance of <i>Apis dorsata</i> in natural and agricultural ecosystems. 2. Explain the nesting biology and behavioral ecology of <i>Apis dorsata</i> with special reference to nest-site selection, foraging behavior, and defensive mechanisms. 3. Discuss the communication systems, swarming, migration, and reproductive behavior of <i>Apis dorsata</i> . 4. Elaborate the role of <i>Apis dorsata</i> in pollination and biodiversity conservation. Discuss the major threats to rock bee populations and suggest suitable conservation and sustainable management strategies.				
MCQ 1. <i>Apis dorsata</i> is commonly known as: a) Italian bee, b) Rock bee, c) Stingless bee, d) Dwarf bee 2. <i>Apis dorsata</i> generally constructs its nest: a) Inside tree cavities, b) Underground, c) In open areas on tall trees or cliffs d) Inside wooden boxes 3. The major role of <i>Apis dorsata</i> in ecosystems is: a) Soil formation, b) Pollination, c) Nitrogen fixation, d) Decomposition 4. The communication method used by honey bees to indicate food sources is called: a) Grooming dance, b) Circular flight, c) Waggle dance, d) Orientation jump 5. The phenomenon in which a colony leaves the nest permanently due to stress or disturbance is known as: a) Swarming, b) Migration, c) Absconding, d) Pollination 8. Which caste in <i>Apis dorsata</i> is primarily responsible for egg laying? a) Worker, b) Drone, c) Queen, d) Guard bee, 9. One major threat to <i>Apis dorsata</i> populations is: a) Afforestation, b) Organic farming, c) Pesticide exposure, d) Rainwater harvesting 10. <i>Apis dorsata</i> is mainly distributed in: a) Europe, b) Antarctica, c) Asia, d) South America				

Rubric for Internal Assessment for Theory Paper

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- SEMESTER – V (NEP)		
Code: 100222	Major Elective-1: <i>Apis dorsata</i> (Rock Bee) – Ecology and Behavior	Max Marks: 20
Sr. No.	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05
5	Overall Performance	05

Practical based on Major Elective-1: *Apis dorsata* (Rock Bee) – Ecology and Behaviour

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100223	V	Practical based on Major Elective-1: <i>Apis dorsata</i> (Rock Bee) – Ecology and Behaviour	02	60	04	Ext.25+ Int. 25

Course Objectives	1. To identify and study the morphology and distinguishing characteristics of <i>Apis dorsata</i>. 2. To understand the nesting habits and colony organization of rock bees in natural habitats. 3. To observe the foraging, defensive, swarming, and communication behaviours of <i>Apis dorsata</i>. 4. To study the ecological relationship between rock bees and flowering plant species. 5. To examine the role of <i>Apis dorsata</i> in pollination and biodiversity conservation. 6. To analyze environmental factors affecting colony distribution and migration. 7. To develop field observation, data collection, and scientific reporting skills related to honeybee ecology. 8. To create awareness regarding conservation and sustainable management of giant honey bees. 9. To provide practical exposure to ecological and behavioural studies under natural conditions. 10. To enhance analytical and research-oriented skills in apiculture and insect ecology
Course Outcome	After successful completion of the practical course, students will be able to: CO1-Identify <i>Apis dorsata</i> and differentiate it from other honeybee species based on morphological and behavioural features. CO2-Explain the nesting ecology, colony structure, and social organization of rock bees. CO3-Observe and interpret major behavioural activities such as foraging, communication, swarming, and colony defence. CO4-Assess the ecological role of <i>Apis dorsata</i> in pollination and ecosystem sustainability. CO5-Conduct field surveys and record ecological and behavioural data scientifically. CO6-Analyze the influence of environmental factors on rock bee distribution and seasonal migration. CO7-Prepare field reports and interpret observations related to honeybee ecology and behaviour. CO8-Develop awareness regarding conservation strategies and sustainable utilization of wild honeybee populations.
List of Experiment/ Exercise	
1. Identification and Morphological Study of <i>Apis dorsata</i>. 2. Study of Nest Structure and Nesting Sites. 3. Observation of Foraging Behaviour. 4. Study of Floral Preferences of Rock Bees. 5. Analysis of Pollination Activity. 6. Study of Defensive Behaviour in <i>Apis dorsata</i>. 7. Observation of Communication Behaviour. 8. Survey of Seasonal Colony Migration. 9. Assessment of Ecological Factors Affecting Colony Distribution.	

10. Biodiversity Survey Around Rock Bee Habitats. 11. Study of Human–Bee Interaction and Conservation Issues. 12. Preparation of Field Report on Rock Bee Ecology.
References/Suggested Digital Resources / E-Contents 1. PLOS ONE Honeybee Ecology Articles 2. Springer Nature – Honeybee Behaviour Studies 3. Journal of Apicultural Research 4. National Bee Board of India 5. FAO Beekeeping and Pollination Resources Recommended Use in Practical Course 1. These manuals and links can support exercises on: 2. Identification of honeybee species 3. Nesting ecology surveys 4. Pollination studies 5. Foraging behaviour observations 6. Defensive and communication behaviour 7. Swarming and migration studies 8. Honeybee conservation awareness

Assessment Rubric for Internal Assessment for Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Apiculture) SEMESTER – V (NEP)	
Code: 100223	Lab: Major Elective-1: <i>Apis dorsata</i> (Rock Bee) – Ecology and Behaviour	Max Marks: 25
Sr. No.	Assessment Criteria	Marks
1	Participation in activities	05
2	Practical Book	05
3	MCQ	10
4	Attendance	05

Assessment Rubric for External Assessment for Practical

E	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Assessment for Lab Work B.Sc.III (Apiculture) SEMESTER – V (NEP)	
Code: 100223	Lab: Major Elective-1: <i>Apis dorsata</i> (Rock Bee) – Ecology and Behavior	Max Marks: 25, Time: 4urs
Sr. No.	Assessment Criteria	Marks
1	Major Experiment	10
2	Minor Experiment -1	05
3	Minor Experiment-2	05
4	Viva-voce	05

Major Elective-2: Fundamentals of Honey Bee Product Processing and Preservation

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100224	V	Major Elective-2: Fundamentals of Honey Bee Product Processing and Preservation	02	30	02hrs	Ext-30 Int-20

Course Objectives	1. Understand the composition, properties, and importance of honey processing. 2. Learn scientific methods of honey extraction, filtration, preservation, and packaging. 3. Acquire knowledge of honey quality standards and evaluation techniques. 4. Identify adulteration and assess the physicochemical and microbiological quality of honey. 5. Develop skills in quality assurance, value addition, branding, and marketing of honey products. 6. Explore entrepreneurship and commercial opportunities in honey processing industries.			
Course Outcome	Upon successful completion of the course, students will be able to: CO-1. Explain the principles and methods involved in honey processing and handling. CO-2. Perform honey extraction, filtration, storage, and packaging using hygienic practices. CO3. Evaluate honey quality using physical, chemical, and microbiological parameters. CO-4. Detect common adulterants and interpret honey quality standards as per FSSAI and international guidelines. CO-5. Prepare and promote value-added honey products for commercial applications. CO-6. Apply quality assurance and marketing strategies in honey processing enterprises.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Introduction to Honey Processing 1.1 Definition, importance, and scope of honey processing 1.2 Composition and physicochemical properties of honey 1.3 Sources and types of honey (floral and regional varieties) 1.4 Honey harvesting, extraction, filtration, and sedimentation methods 1.5 Hygienic handling and sanitation practices during honey processing.	8	8	Lecture Method Demonstration Method Hands-on Practical Training Experiential Learning Field Visits / Industrial Visits Project-Based Learning. Problem-Solving Approach Group Discussion

Unit-II	Honey Processing Techniques 2.1 Honey extraction equipment and processing units 2.2 Straining, filtration, moisture reduction, and clarification techniques 2.3 Heating and pasteurization of honey: principles and precautions 2.4 Creamed honey and crystallization control methods 2.5 Packaging, storage, labeling, and transportation of processed honey.	7	7	and Seminar Audio-Visual Teaching Skill-Oriented Training. Inquiry- Based Learning. ICT-Enabled Learning. Collaborative Learning Laboratory-Based Learning. Entrepreneurship-Oriented Pedagogy
Unit-III	Quality Evaluation of Honey 3.1 Standards and specifications of honey (FSSAI, AGMARK, Codex standards) 3.2 Physical quality parameters: color, viscosity, aroma, and granulation 3.3 Chemical quality parameters: moisture, pH, acidity, sugars, HMF, ash content 3.4 Detection of adulteration in honey 3.5 Microbiological quality and safety assessment of honey.	8	8	
Unit-IV	Quality Assurance, Marketing and Value Addition 4.1 Quality control and quality assurance in honey processing industries 4.2 Good Manufacturing Practices (GMP) and HACCP in honey processing 4.3 Value-added honey products: flavored honey, herbal honey, comb honey, infused honey 4.4 Branding, certification, and export potential of honey 4.5 Entrepreneurship opportunities in honey processing and marketing.	7	7	

References:

1. Crane, E. (1990). *Bees and Beekeeping: Science, Practice and World Resources*. Cornell University Press.
2. Graham, J. M. (2015). *The Hive and the Honey Bee*. Dadant and Sons, Hamilton, Illinois.
3. Sammataro, D. & Avitabile, A. (2021). *The Beekeeper's Handbook* (5th Edition). The Beekeeper's Handbook Cornell University Press.
4. Panda, H. (2017). *Complete Technology Book on Honey Processing and Formulations*. Asia Pacific Business Press Inc., New Delhi.
5. Subrahmanyam, M. (2007). *Honey Processing and Quality Control*. Indian Bee Journal Publications.

6. Krell, R. (1996). <i>Value-Added Products from Beekeeping</i>. Food and Agriculture Organization (FAO), Rome. 7. Bogdanov, S. (2009). <i>Honey Composition and Properties</i>. Bee Product Science Publications. 8. Nayik, G., Uddin, J., & Nanda, V. (2024). <i>Advanced Techniques of Honey Analysis: Characterization, Authentication, and Adulteration</i>. Elsevier Science. 9. Toledo, V. A. A. (Ed.). (2017). <i>Honey Analysis</i>. IntechOpen Publications. 10. Wu, L. & Li, Q. (2023). <i>Quality Evaluation of Bee Products</i>. MDPI Books. 11. Puścion-Jakubik, A., Borawska, M. H., & Socha, K. (2020). "Modern Methods for Assessing the Quality of Bee Honey and Botanical Origin Identification." <i>Foods</i>, 9(8), 1028. 12. Sanna, G., Ciulu, M., Picò, Y., Spano, N., & Tuberoso, C. (2022). <i>Progress in Analytical Methods for the Characterization, Quality and Safety of the Beehive Products</i>. MDPI Books.
Model Questions
Short Type: 1. Define honey processing and explain its importance. 2. What are the major components of honey? 3. Differentiate between raw honey and processed honey. 4. What is the purpose of filtration in honey processing? 5. Define HMF and state its significance in honey quality evaluation. 6. List any four physical quality parameters used in honey analysis. 7. What are the common methods used for detection of honey adulteration? 8. Explain the importance of proper packaging and storage of honey.
Long Type: 1. Explain the processing techniques of honey from extraction to packaging. Discuss the factors affecting honey quality and methods used for its preservation. 2. Describe the composition, collection, processing, and storage of major honey bee products such as beeswax, royal jelly, pollen, propolis, and bee venom. 3. Discuss various methods used for preservation of honey bee products. Explain the importance of temperature, moisture control, hygiene, and packaging in maintaining product quality. 4. Explain the common problems associated with honey processing and storage such as fermentation, crystallization, adulteration, and contamination. Suggest suitable preventive and quality control measures. 5. Discuss the role of value addition, quality standards, labeling, and marketing in commercialization of honey bee products. Explain the entrepreneurial opportunities in honey bee product processing industries.
MCQ 1. Which instrument is commonly used for measuring moisture content in honey? a) Lactometer, b) Refractometer, c) Hygrometer, d) Thermometer 2. The major sugar present in honey is: a) Sucrose, b) Maltose, c) Fructose, d) Lactose 3. Which process is mainly used to remove wax particles and impurities from honey? a) Fermentation, b) Filtration, c) Crystallization, d) Distillation 4. High moisture content in honey may lead to: a) Crystallization, b) Fermentation, c) Pasteurization, d) Caramelization 5. HMF in honey stands for: a) Hydroxy Methyl Fructose, b) Hydroxymethylfurfural, c) Hexa Methyl Fructose d) Hydroxy Maltose Factor 6. Which organization sets food safety standards for honey in India? a) ICAR, b) NABARD, c) FSSAI, d) APEDA 7. Creamed honey is prepared mainly by controlling: a) Fermentation, b) Heating, c) Crystallization, d) Acidity

8. Which of the following is a value-added honey product?
a) Honey wax, b) Herbal infused honey, c) Pollen grain, d) Propolis extract

Rubric for Internal Assessment for Theory Paper

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- SEMESTER – V (NEP)		
Code:100224	Major Elective-2: Fundamentals of Honey Bee Product Processing and Preservation	Max Marks: 20
Sr. No.	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05
5	Overall Performance	05

Practical/-Major Elective-2 Fundamentals of Honey Bee Product Processing and Preservation

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100225	V	Practical/-Major Elective-2 Fundamentals of Honey Bee Product Processing and Preservation	02	60	04	Ext.25+ Int. 25

Course Objectives	1. To familiarize students with honey extraction, processing, and handling equipment. 2. To develop practical skills in honey filtration, clarification, preservation, and packaging. 3. To train students in physicochemical analysis of honey quality parameters. 4. To provide hands-on experience in detection of honey adulteration and quality defects. 5. To develop competency in microbiological and safety evaluation of honey samples. 6. To understand methods of preparation of value-added honey products. 7. To enhance knowledge of quality standards, labeling, and storage practices for honey. 8. To expose students to commercial honey processing and marketing practices through field visits.
-------------------	---

Course Outcome	After successful completion of the practical course, students will be able to: CO-1. Operate honey extraction and processing equipment safely and efficiently. CO-2. Perform honey filtration, clarification, moisture reduction, and packaging procedures. CO-3. Analyze honey samples for moisture, pH, acidity, sugar content, ash, and HMF. CO-4. Detect common adulterants and assess the authenticity of honey. CO-5. Conduct microbiological examination and interpret honey safety parameters. CO-6. Prepare value-added honey products such as flavored and herbal honey. CO-7. Apply food safety standards and labeling regulations in honey processing. CO-8. Demonstrate understanding of commercial honey processing operations and quality management practices.
----------------	--

List of Experiment/ Exercise

1. Study of different types of honey and identification based on color, aroma, and texture.
2. Demonstration and handling of honey extraction equipment and processing tools.
3. Extraction of honey from combs using centrifugal honey extractor.
4. Filtration and clarification of raw honey for removal of impurities.
5. Determination of moisture content in honey using refractometer.
6. Measurement of pH and acidity of honey samples.
7. Estimation of reducing sugars and total sugars in honey.
8. Determination of ash content and electrical conductivity of honey.
9. Estimation of Hydroxymethyl furfural (HMF) content in honey.
10. Detection of common adulterants in honey by simple laboratory methods.
11. Comparative quality evaluation of raw honey and processed honey.
12. Study of crystallization behaviour and preparation of creamed honey.
13. Packaging and labelling of processed honey as per food safety guidelines.
14. Microbiological examination of honey samples for quality and safety assessment.
15. Preparation of value-added honey products such as flavored honey or herbal honey.
16. Visit to a honey processing unit or apiary for observation of commercial honey processing practices.

References:

1. Association of Official Analytical Chemists (AOAC). (2019). *Official Methods of Analysis of AOAC International* (21st Edition). AOAC International, Maryland, USA.
2. Standard methodologies for moisture, acidity, sugar estimation, ash, HMF, and adulteration analysis in honey.
3. Codex Alimentarius Commission. (2001). *Codex Standard for Honey (CODEX STAN 12-1981, Revised 2001)*. Food and Agriculture Organization (FAO) and World Health Organization (WHO), Rome.
4. International standards and analytical procedures for honey quality evaluation. Bogdanov, S. (2009). *Harmonised Methods of the International Honey Commission*. International Honey Commission, Switzerland.
5. Comprehensive laboratory methods for physicochemical and microbiological analysis of honey.
6. Subrahmanyam, M. (2007). *Honey Processing and Quality Control*. Indian Bee Journal Publications.
7. Practical procedures for honey extraction, filtration, processing, and quality testing.
8. Krell, R. (1996). *Value-Added Products from Beekeeping*. FAO Agricultural Services Bulletin No. 124, Rome.
9. Methodologies for preparation of flavored, herbal, and processed honey products.
10. National Bee Board, India. (2020). *Training Manual on Scientific Beekeeping and Honey Processing*. Ministry of Agriculture & Farmers Welfare, Government of India.
11. Standard operational practices for extraction, processing, packaging, and storage of honey.
12. FSSAI. (2023). *Food Safety and Standards (Food Products Standards and Food Additives) Regulations – Honey Standards*. Food Safety and Standards Authority of India, New Delhi.
13. Guidelines for packaging, labeling, quality standards, and adulteration limits.
14. Crane, E. (1990). *Bees and Beekeeping: Science, Practice and World Resources*. Cornell University Press, USA.
15. Techniques related to honey harvesting, handling, and processing practices.
 - Toledo, V. A. A. (Ed.). (2017). *Honey Analysis*. IntechOpen Publications.
 - 16. Modern analytical techniques for honey characterization and quality assessment. Puścion-Jakubik, A., Borawska, M. H., & Socha, K. (2020).
- 17. “Modern Methods for Assessing the Quality of Bee Honey and Botanical Origin Identification.” *Foods*, 9(8), 1028. .
- 18. Advanced methodologies for quality testing, authentication, and adulteration detection in honey.

E-Contents / E-Books / Digital Resources / Web Links;

1. [FAO – Value Added Products from Beekeeping](#)
2. Comprehensive digital manual covering honey extraction, processing, quality control, packaging, and value-added bee products.
3. [FAO Chapter on Honey Harvesting and Processing](#)
4. Detailed resource on honey harvesting, purification, moisture control, fermentation prevention, heating, and storage methods.
5. [FAO Introduction to Value-Added Bee Products](#)
6. Explains value addition, processing, packaging, and marketing of honey and bee products.
7. [FAO Foreword on Beekeeping Product Processing and Diversification](#)
8. Useful background resource on diversification, quality improvement, and processing technologies in beekeeping.
9. [Codex Alimentarius – International Honey Standards](#)
10. International standards for honey quality, safety, labeling, and analytical methods.
11. [FSSAI – Food Safety and Standards Authority of India](#)
12. Official Indian standards and regulations related to honey quality evaluation, packaging, and adulteration control.

13. ResearchGate – Harmonised Methods of the International Honey Commission
14. Standard laboratory methodologies for honey analysis including moisture, acidity, sugars, HMF, and electrical conductivity.
15. ResearchGate – Honey Quality, Methods of Analysis and International Regulatory Standards

Assessment Rubric for Internal Assessment for Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Apiculture) SEMESTER V (NEP)	
Code: 100225	Lab: Practical/-Major Elective-2 Fundamentals of Honey Bee Product Processing and Preservation	Max Marks: 25
Sr. No.	Assessment Criteria	Marks
1	Participation in activities	05
2	Practical Book	05
3	MCQ	10
4	Attendance	05

Assessment Rubric for External Assessment for Practical

E	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Assessment for Lab Work B.Sc.III (Apiculture) SEMESTER –V (NEP)	
Course Code: 100225	Lab: Practical/-Major Elective-2 Fundamentals of Honey Bee Product Processing and Preservation	Max Marks: 25, Time: 4Hours
Sr. No.	Assessment Criteria	Marks
1	Major Experiment	10
2	Minor Experiment -1	05
3	Minor Experiment-2	05
4	Viva-voce	05

Minor: Bee-Pollination Management

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100226	V	Minor : Bee-Pollination Management	02	30	02	Ext-30 Int-20

Course Objectives	1. To provide knowledge about the importance of bee pollination in agriculture. 2. To understand the role of honeybees in improving crop yield and quality. 3. To develop skills in bee-pollination management practices. 4. To identify major crops benefitted by bee pollination. 5. To create awareness about pollinator conservation and safe pesticide use. 6. To introduce modern techniques and commercial aspects of pollination management.			
Course Outcome	After completion of the course, students will be able to: CO-1. Explain the importance and process of bee pollination in crop production. CO-2. Identify different crops that benefit from honeybee pollination. CO-3. Apply basic bee-pollination management techniques in agricultural fields. CO-4. Manage bee colonies effectively for pollination purposes. CO-5. Recognize factors affecting pollination efficiency and bee health. CO-6. Understand the importance of pollinator conservation for sustainable agriculture.			
Unit System	Content	Workload Allotted (Hrs)		Incorporation of Pedagogies
Unit-I	Basics of Bee Pollination 1.1. Importance of bee pollination 1.2 . Types of pollination 1.3. Role of honeybees in agriculture 1.4. Pollination behaviour of bees	8	8	Classroom lectures Apiary demonstrations Hands-on grafting practice Field visits to queen-rearing units Audio-visual presentations Record maintenance exercises
Unit-II	Bee-Pollination Management 2.1. Selection of bee colonies 2.2. Placement and management of colonies in fields 2.3. Transportation and handling of colonies 2.4. Factors affecting pollination efficiency	7	7	
Unit-III	Crops Benefitted by Bee Pollination 3.1. Fruit crops benefitted by bee pollination 3.2. Vegetable and oilseed crops 3.3. Pulse, spice and plantation crops 3.4. Effect of pollination on yield and quality	8	8	
Unit-IV	Problems and Modern Practices 4.1. Pesticide hazards and bee protection 4.2. Environmental effects on pollination 4.3. Commercial pollination services 4.4. Conservation of pollinators and recent advances	7	7	
References				
1. Free, J.B., <i>Insect Pollination of Crops</i> , Academic Press, London. A classic reference on pollination biology and crop pollination management. 2. Mishra, R.C., <i>Honey Bees and Their Management in India</i> , ICAR Publications. Covers bee management, pollination services, and Indian agricultural crops. 3. Morse, R.A. & Calderone, N.W., <i>The Value of Honey Bees as Pollinators of U.S. Crops</i> , Cornell University Press., Discusses economic importance of bee pollination. 4. Abrol, D.P. <i>Pollination Biology: Biodiversity Conservation and Agricultural Production</i> , Springer. Comprehensive book on pollination ecology and crop productivity.				

5. Abrol, D.P., *Bees and Beekeeping in India*, Kalyani Publishers. Includes pollination management practices and bee flora.
6. Crane, Eva, *Bees and Beekeeping: Science, Practice and World Resources* Heinemann Newnes., Important global reference on bee biology and pollination.
7. McGregor, S.E. *Insect Pollination of Cultivated Crop Plants*, USDA Handbook. Detailed crop-wise pollination requirements and bee management.
8. Williams, I.H., *Bee Pollination in Agricultural Ecosystems*, Oxford University Press. Explains bee-mediated pollination systems in farming ecosystems.

Useful E-Books / Digital Resources / Web Links

1. Food and Agriculture Organization (FAO)
Bee pollination, biodiversity, and sustainable agriculture resources.
[FAO Pollination Resources](#)
2. National Bee Board, India
Indian beekeeping schemes, pollination management, and crop pollination guides.
[National Bee Board of India](#)
3. ICAR – Indian Agricultural Research Institute
Research and extension materials on pollination management.
[ICAR-IARI](#)
4. ICAR – Central Bee Research & Training Institute
Training manuals and apiculture resources.
CBRTI Pune
5. USDA Pollinator Information
Crop pollination requirements and bee management resources.
[USDA Pollinator Resources](#)
6. Xerces Society for Pollinator Conservation
Educational materials on pollinator-friendly farming practices.
[Xerces Society](#)
7. Pollinator Partnership
Guides on crop pollination and pollinator conservation.
[Pollinator Partnership](#)
8. Journal of Apicultural Research
Research articles on pollination ecology and bee management.
[Journal of Apicultural Research](#)
9. Springer Nature – Pollination Biology
Research publications and e-books on pollination science.
Springer Pollination Biology
10. ScienceDirect – Bee Pollination Research
Research database for crop pollination and bee ecology.
[ScienceDirect Bee Pollination](#)

Model Questions

Short Questions:

1. Define pollination.
2. What is bee pollination?
3. Name two important pollinating bee species.
4. Differentiate between self and cross pollination.
5. Why are honeybees important in agriculture?
6. What is meant by pollination efficiency?
7. Mention two factors affecting bee activity.
8. What is the ideal time for placing bee colonies in crop fields?
9. Define managed pollination.
10. What is the role of worker bees in pollination?
11. Name two fruit crops benefitted by bee pollination.
12. Name two vegetable crops requiring bee pollination.
13. Mention two oilseed crops benefitted by honeybees.

Long Questions:

1. Explain the importance of bee pollination in agriculture and crop production.
2. Describe the role of honeybees in improving yield and quality of crops.
3. Explain the behaviour of honeybees during pollination activities.

4. Describe the principles and practices of bee-pollination management.
5. Explain the methods of selection, preparation and maintenance of bee colonies for pollination work.
6. Discuss the placement and transportation of bee colonies for effective crop pollination.
7. Explain the factors affecting pollination efficiency in honeybees.
8. Explain the role of honeybees in pollination of oilseed and pulse crops.

MCQ:

1. Pollination is the transfer of pollen grains from
a) Ovary to stigma, b) Anther to stigma, c) Leaf to flower, d) Root to stem
2. The most important pollinating insect in agriculture is
a) Butterfly, b) Ant, c) Honeybee, d) Beetle
3. Bee pollination helps in increasing
a) Soil erosion, b) Crop yield, c) Weed growth, d) Plant diseases
4. Which of the following crops greatly benefits from bee pollination?
a) Wheat, b) Sunflower, c) Rice, d) Sugarcane
5. Worker bees are mainly responsible for
a) Egg laying, b) Pollination and foraging, c) Mating, d) Hive destruction
6. The ideal colony used for pollination should be
a) Weak, b) Queenless, c) Strong and healthy, d) Empty
7. Which of the following is a vegetable crop requiring bee pollination?
a) Onion, b) Wheat, c) Barley d) Maize
8. Bee colonies are placed in fields mainly for
a) Honey extraction only, b) Wax production, c) Effective pollination, d) Hive decoration
9. Honeybees collect _____ from flowers.
a) Sand, b) Nectar and pollen, c) Stones, d) Mud

Rubric for Internal Assessment for Theory Paper

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- Apiculture SEMESTER – V (NEP)		
Code:100226	Minor Paper: Bee-Pollination Management	Max Marks: 20
Sr. No.	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05
5	Overall Performance	05

Practical Minor : Bee-Pollination Management

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100227	V	Practical Minor: Bee-Pollination Management	02	60	04	Ext.25+ Int. 25

Course Objectives	- To identify important bee species and other insect pollinators associated with agricultural and horticultural crops. - To study the foraging behaviour and pollination activity of bees on different crop plants. - To understand the floral biology and pollination requirements of economically important crops. - To assess the role of bee pollination in improving crop yield, seed set, and fruit quality. - To develop skills in field observation, pollinator monitoring, and ecological data collection. - To examine the influence of environmental factors on pollinator activity and crop pollination. - To study pollination management practices in agricultural ecosystems. - To evaluate the impact of pesticides and other human activities on pollinator populations. - To promote awareness regarding conservation of pollinators and sustainable agriculture. - To develop scientific and analytical skills related to pollination ecology and crop management.
Course Outcome	After successful completion of the experiments/exercises, students will be able to: CO1-Identify major bee pollinators and explain their importance in agricultural ecosystems. CO2-Observe and interpret pollinator behaviour and floral interactions in crop plants. CO3-Analyze the role of bee pollination in enhancing crop productivity and quality. CO4-Conduct field-based studies related to pollination management and pollinator diversity. CO5--ssess environmental and ecological factors influencing pollinator activity. CO6-Apply basic pollination management techniques for agricultural and horticultural crops. CO7-Evaluate the effects of pesticides and habitat changes on pollinator populations. CO8-Prepare scientific field reports and present data related to crop pollination studies. CO9-Develop awareness regarding pollinator conservation and sustainable farming practices. CO10-Enhance practical, observational, and research-oriented skills in bee-pollination management.
List of Experiment/ Exercise	
Identification of Important Pollinator Bee Species: Study and identify major bee species involved in crop pollination using charts, photographs, or field observations. Observation of Bee Foraging Behaviour on Crop Plants: Record the time, frequency, and duration of bee visits on selected flowering crops. Study of Floral Biology of Pollinated Crops: Examine flower structure, flowering period, nectar production, and pollen availability in bee-pollinated crops. Assessment of Pollination Efficiency in Different Crops: Compare fruit set, seed set, or yield in open-pollinated and pollinator-excluded plants. Preparation of Crop Pollination Calendar: Develop a seasonal calendar showing flowering periods and corresponding pollinator activity of local crops. Study of Honey Bee Colony Placement in Agricultural Fields: Observe and evaluate suitable colony placement for effective crop pollination management. Survey of Crops Benefitted by Bee Pollination: Conduct field surveys to document agricultural and horticultural crops dependent on bee pollination.	

8. **Effect of Bee Pollination on Crop Yield and Quality::** Compare size, weight, shape, and quality parameters of crops under bee-pollinated and non-pollinated conditions.
9. **Observation of Pollinator Diversity in Agroecosystems:** Record different pollinating insects visiting crop flowers and analyze their relative abundance.
10. **Study of Environmental Factors Affecting Pollinator Activity:** Observe the influence of temperature, humidity, rainfall, wind speed, and light intensity on bee foraging.
11. **Preparation of Artificial Bee Attractants or Pollinator-Friendly Gardens:** Design small pollinator-friendly plots using flowering plants to attract bees and other pollinators.
12. **Survey of Pesticide Impact on Pollinator Population:** Assess the effect of pesticide application on bee visitation and pollinator diversity in crop fields.
13. **Study of Nectar and Pollen Sources of Major Crops:** Identify major nectariferous and pollen-producing crops in the local area.
14. **Demonstration of Managed Pollination Techniques:** Learn practical methods of introducing bee colonies into crop fields for commercial pollination.
15. **Preparation of Field Report on Bee Pollination Management:** Compile field observations, data analysis, photographs, and conclusions related to pollination studies.

References/E-Contents / E-Books/ Digital Resources / Web Links:

Practical Manuals

1. **Practical Manual on Beekeeping and Pollination Management**
Covers identification of pollinators, bee colony management, crop pollination techniques, and field exercises.
ICAR Practical Manual on Beekeeping and Pollination
2. **Manual of Pollination Biology and Bee Management**
Includes practical exercises on floral biology, pollinator observation, and crop pollination studies.
Pollination Biology Manual
3. **Practical Manual of Apiculture**
Useful for experiments related to bee behaviour, colony handling, and pollination efficiency.
Apiculture Practical Manual
4. **USDA Handbook on Insect Pollination of Cultivated Crop Plants**
Comprehensive crop-wise pollination guide and practical reference.
USDA Pollination Handbook
5. **FAO Training Manual on Beekeeping and Pollination**
Practical resource for bee management and pollination practices in agriculture.
FAO Beekeeping Manual

Digital Resources / E-Contents

National Bee Board of India

Resources on bee pollination management, crop pollination, and beekeeping practices in India.

ICAR – Central Bee Research and Training Institute (CBRTI)

Training materials and practical resources related to apiculture and pollination.

Pollinator Partnership

Educational materials on pollinator conservation and crop pollination.

Xerces Society for Pollinator Conservation

Practical guides for pollinator-friendly farming and habitat management.

Journal of Apicultural Research

Research papers and case studies on bee pollination and crop productivity.

Assessment Rubric for Internal Assessment for Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Apiculture) SEMESTER –V (NEP)	
Code: 100227	Lab: Minor Paper: Bee-Pollination Management	Max Marks: 25
Sr. No.	Assessment Criteria	Marks
1	Participation in activities	05
2	Practical Book	05
3	MCQ	10
4	Attendance	05

Assessment Rubric for External Assessment for Practical

E	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Assessment for Lab Work B.Sc.III (Apiculture) SEMESTER –V (NEP)	
Course Code: 100227	Lab: Minor Paper: Bee-Pollination Management	Max Marks: 25, Time: 4Hours
Sr. No.	Assessment Criteria	Marks
1	Major Experiment	10
2	Minor Experiment -1	05
3	Minor Experiment-2	05
4	Viva-voce	05

VSC: Bee health monitoring and bee enemies

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100276	V	VSC: Bee health monitoring and bee enemies	02	60	04	Int. 50

Course Objectives	1. Understand the importance of honey bee health in apiculture and agriculture. 2. Identify common honey bee diseases, pests, predators, and enemies. 3. Learn techniques for monitoring colony health and disease symptoms. 4. Develop practical skills in apiary inspection and diagnosis. 5. Apply preventive and integrated management practices for healthy colonies. 6. Promote sustainable beekeeping and pollination management.
Course Outcome	Upon successful completion of the course, students will be able to: CO-1. Diagnose major honey bee diseases and pests. CO-2. Monitor bee colony health using standard techniques. CO-3. Differentiate symptoms of bacterial, viral, fungal, and protozoan diseases. CO-4. Apply preventive and control measures for bee enemies and predators. CO-5. Maintain healthy apiaries through scientific management practices. CO-6. Demonstrate practical skills in hive inspection, sampling, and record keeping.
List of Experiment/ Exercise	
Introduction to Bee Health Monitoring: ☐ Identification of healthy and unhealthy colonies ☐ Observation of brood pattern and colony behaviour ☐ Maintenance of bee health records. ☐ Use of protective and diagnostic equipment Honey Bee Diseases: ☐ Identification of symptoms of major diseases ☐ Collection and preservation of diseased samples ☐ Microscopic examination of infected bees ☐ Preparation of disease diagnosis charts Bee Enemies, Pests and Predators: ☐ Identification of bee pests and predators ☐ Observation of damaged combs and colonies ☐ Demonstration of pest monitoring techniques ☐ Field survey of apiary enemies Management and Preventive Measures: ☐ Cleaning and sterilization of beekeeping equipment ☐ Preparation of sugar syrup and supplemental feed ☐ Demonstration of IPM techniques ☐ Preparation of awareness materials on bee diseases ☐ Apiary visit and field diagnosis 1. Identification of healthy and diseased bee colonies. 2. Study of brood abnormalities. 3. Identification of wax moth and mites. 4. Microscopic study of Nosema spores. 5. Preparation of apiary inspection records. 6. Monitoring colony population strength. 7. Survey of local bee predators. 8. Demonstration of hive sanitation methods. 9. Diagnosis of common bee diseases. 10. Integrated pest management practices in apiaries.	
References: 1. Apiculture – P. J. Prost 2. Beekeeping in India – S. Singh	

3. Apiculture – D. S. Bisht
4. The ABC and XYZ of Bee Culture – A.I. Root
5. Honey Bee Diseases and Pests – Canadian Association of Professional Apiculturists
6. Practical Beekeeping – Clive de Bruyn

Digital Resources / Web Links

- [University of Florida Apiculture Courses](#)
- [California Master Beekeeper Program – Honey Bee Health](#)
- [National Diploma in Beekeeping – Adult Bee Diseases Course](#)
- [Apiology 101 – Integrated Pest Management](#)
- [Central Council of Vocational Training and Skill Education – Beekeeping](#)

Assessment Rubric for Internal Assessment for Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Apiculture) SEMESTER –V (NEP)	
Code: 100276	Lab: VSC: Bee health monitoring and bee enemies	Max Marks:50
Sr. No.	Assessment Criteria	Marks
1	Bee Health Monitoring:	10
2	Honey Bee Diseases:	10
3	Bee Enemies, Pests and Predators:	10
4	Management and Preventive Measures:	10
5	Report Writing	10

Hands-on Training in Beekeeping Equipment and Hive Product Extraction

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	100277	SEC: Hands-on Training in Beekeeping Equipment and Hive Product Extraction	2	60	4Hrs	Inty-50

Course Objectives:	- To learn the methods of extraction of bee hive product. - To learn principle and working of hive product extraction equipment. - To familiarize learners with the identification, handling, maintenance, and safe use of essential beekeeping equipment and tools. - To develop practical skills in the installation and management of different types of bee hives and accessories. - To impart knowledge of hygienic and efficient techniques for honey extraction, filtration, processing, and storage. - To provide hands-on experience in the collection and processing of other hive products such as beeswax, pollen, propolis, royal jelly, and bee venom. - To develop competency in maintaining quality standards, cleanliness, and food safety during hive product extraction and handling. - To train learners in the maintenance and sterilization of extraction equipment to prevent contamination and disease spread. - To enhance entrepreneurial and vocational skills related to beekeeping product processing, packaging, and value addition. - To prepare students for self-employment, small-scale beekeeping enterprises, and apiary-based livelihood opportunities.
Course Outcomes:	After successful completion of the course, learners will be able to: CO-1. Identify and properly use various beekeeping tools, equipment, and protective devices required for apiary management. CO-2. Operate honey extraction and processing equipment efficiently while maintaining hygiene and safety standards. CO-3. Extract, process, and store honey and other hive products such as beeswax, pollen, propolis, and royal jelly using scientific methods. CO-4. Maintain cleanliness, sanitation, and quality control during handling and packaging of hive products. CO-5. Develop vocational and entrepreneurial competencies for employment or self-employment in beekeeping and allied industries.
Contents	
1	Study Types, principle and working of Honey Extractor (<i>A.cerena</i> , and <i>A. mellifera</i>)
2.	Extraction of wax from comb.
3.	Bleaching of comb.
4	Applications of honey testing kit.
5	Study of pollen extractor and to extract pollen from bees.
6	Study of smokers- Its working and advantages.
7	Measurement of moisture content of honey by refractometer.
8	Study of Centrifuge – how to extract pollen from honey.
9	Extraction of Royal Jelly.

10	Study of venom extractor and to extraction of bee venom
REFERENCES:	
1. The ABC & XYZ of Bee Culture – A comprehensive manual covering beekeeping equipment, hive management, honey extraction, and processing techniques. 2. Beekeeping for Beginners – Practical handbook on hive tools, colony handling, and honey harvesting methods. 3. The Beekeeper's Handbook – Standard practical manual for apiary management and hive product extraction. 4. Honeybee Diseases and Their Management – Useful for hygienic handling of hive products and equipment sanitation. 5. Food and Agriculture Organization training manuals on small-scale beekeeping and hive product processing. 6. <u>National Bee Board, India</u> – Training materials, manuals, and technical guidelines related to beekeeping and honey processing. 7. <u>Khadi and Village Industries Commission (KVIC)</u> – Manuals and vocational training resources on beekeeping equipment and honey extraction. 8. Central Bee Research and Training Institute (CBRTI) – Technical training resources for scientific beekeeping and hive product management. 9. Practical Manual of Beekeeping – Covers operation of extractors, wax processing, and hive maintenance. 10. Honey Hunting and Beekeeping in India – Reference on Indian beekeeping practices and hive product utilization. 11. FAO Beekeeping Resources – International practical manual on beekeeping and hive product processing. 12. <u>ICAR – Indian Agricultural Research Institute</u> – Academic and extension resources related to apiculture and honey technology. 13. Asian Beekeeping Manual – Practical guidance on hive management and extraction technologies. 14. Value Added Products from Beekeeping – Focus on processing, packaging, and marketing of hive products. 15. <u>Apimondia – International Federation of Beekeepers' Associations</u> – Global technical resources and manuals on modern beekeeping practices.	

Rubric for Internal ssessment for Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI VSC: External Assessment for Lab Work B.Sc.III (Apiculture) SEMESTER –V (NEP)	
Course Code: 100277	SEC: Hands-on Training in Beekeeping Equipment and Hive Product Extraction	Max Marks: 50
Sr. No.	Assessment Criteria	Marks
1	Practical demonstration (50%)	25
2	Attendance and participation (20%)	10
3	Viva or MCQ (30%)	15

Field Project / Community Engagement Services in Apiculture

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
5.5	V	100228	Field Project / Community Engagement Services in Apiculture:	2	60	--	50

Course Objectives:

1. To deepen field-based understanding of honey bees, conservation practices, and community-linked bee knowledge.
2. To engage students in solving real-world problems through honey bee interventions and sustainability projects.
3. To promote Apiculture innovation and outreach via community collaboration.
4. To enhance project planning, execution, documentation, and dissemination skills.

Course Outcomes:

Upon successful completion of this course, students will be able to:

- CO-1: Design and implement field-based apicultural studies and service projects.
- CO-2: Collaborate with rural/urban communities in addressing ecological challenges.
- CO-3: Apply indigenous and scientific bee keeping knowledge for sustainable outcomes.
- CO-4: Reflect on the social, ethical, and ecological impact of their interventions.
- CO-5: Present findings effectively through reports, posters, and public engagement.

Guidelines/ SoP for FP/CEP

For understanding key principles of CE, forms of CE, operational guidelines and implementation strategy please refer https://www.ugc.gov.in/pdfnews/4187860_Revised-Final-Guidelines.pdf

As per NEP 2020, students of B Sc. II of Semester III and IV need to perform a Field Project (FP) for TWO (2) credits i.e. 50 Marks.

The guidelines regarding the field project are as follows:

This stage should empower students not just to study nature with curiosity, but to engage with communities in stewardship—even in small, humble ways.

Project Format and Deliverables

Component	Description
Duration	60 hours total (fieldwork + report writing + presentation)
Group Size	Individual or up to 4 students
Guide	Supervised by departmental faculty
Project Types	Survey-based, experimental, participatory, or interventionist
Final Output	Written report + Presentation + Community feedback
Evaluation	Internal (faculty) + External (appointed examiner) = 50 marks

Suggested Project Types & Methodology

1. Problem-Solving/Intervention Projects

- Define a tangible issue (e.g., low/high availability of bee colonies, availability of bee flora, awareness about importance of honey bees, honey extraction and role of pollination in local farmers and community).
- Design and implement a simple solution: improved propagation of bee flora and scientific methods for honey extraction. etc.
- Follow up for awareness.

2. Community Co-Creation

- Collaborate with local SHGs, farmers, school eco-clubs, or NGOs.
- Involve them in designing part of the project (honey bee species, bee flora, structure of bee colony, acquiring bee colonies in pot).
- Document shared knowledge and reciprocal learning.

3. Extended Surveys with Action

Move from just documenting (Phase I) to evaluating & advising:

e.g., from “knowledge of honey bees to tribal communities” to “reviving forgotten uses through school campaigns.”

Or from “identifying bee and bee plants rare species” to “creating signage for local bee trails.”

Field Protocol (Concise Steps)

1. Reassess Phase I findings: What insights, gaps, or opportunities emerged?
2. Design upgrade: Choose a focus: ecological impact, community outreach, practical testing and finalize objectives, participants, tools, and timeline
3. Execute fieldwork: Collect refined data and Conduct activities: bee trials, awareness sessions, school visits, community experiments
4. Monitor & Record: Use datasheets, photos, interviews, impact logs
5. Analyze: Compare results or outcomes (even in basic visual/statistical form)
6. Document & Present: Full report + visual presentation, Include community reflection or feedback if possible

Report Format (Minimum 6 pages excluding Title, Certificate, Acknowledgement and appendices):

7. Title Page
8. Certificate
9. Acknowledgement
10. Main Report:
11. Introduction
12. Objectives
13. Methodology
14. Observations/Data
15. Discussion
16. Suggestions/Interventions
17. Conclusion

18. References

19. Community Co-Creation

- Collaborate with local SHGs, farmers, school eco-clubs, or NGOs.
- Involve them in designing part of the project (honey bee species, bee flora, structure of bee colony, acquiring bee colonies in pot).
- Document shared knowledge and reciprocal learning.

Extended Surveys with Action

Move from just documenting (Phase I) to evaluating & advising:

- Ensure voluntary community participation and informed consent.
- Avoid projects that may involve sensitive ecological areas or protected species without permissions.
- Encourage documentation in regional languages where applicable.

Assessment Rubric for FP/CES

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI PRACTICAL EXAMINATION B.Sc. III (Apiculture), SEMESTER –V (NEP)		
Course Code:100 2281	Field Project / Community Engagement Services in Apiculture	Max Marks: 50
Q. No.	Exercise	Marks
1	Field Engagement & Application of Knowledge	10
2	Quality of Intervention/Innovation	10
3	Documentation & Report Writing	10
4	Outcome of the Project Work	10
5	Oral/Poster Presentation	10

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI

FACULTY: Science and Technology

Subject: APICULTURE

Teaching and Learning Scheme: for the Degree of Bachelor of Apiculture (B.Sc.)

Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme

THIRD YEAR: Level 5.5 - SEMESTER – VI (T & L Credit Scheme)

Mode of Teaching	Ver. No	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field	a.	Major	Theory-10	100229	Bee Diseases and Their Management.	2	2	20
			Theory-11	100230	Bee Pests, Predators, and Enemy Management	2	2	
			Theory-12	100231	Composition & Quality of Honey.	2	2	
			Lab/Practical-15	100232	Pract. On Major -10,11 & 12	2	4	
	Major (Elective)		Theory1	100233	<i>Apis dorsata</i> (Rock bee) – Honey Harvesting and conservation	2	2	
			Lab/Practical-17	100234	Pract on Elective-3			
			Theory2	100235	Advance Processing, value addition and Quality management of Honey Bee Product	2	4	
			Lab/Practical-17	100236	Pract on Elective-4			
	b.	Minor	Theory5	100237	Inspection of Bee Colonies.	2	2	6
			Lab/Practical-18	100238		2	4	
	c.	Generic/Open Elective	-	-	-	-	-	-
	d.	VSC	Lab/Practical-19	100278	VSC: Entrepreneurship Development in Apiculture	2	4	4
		SEC	-	-	-	-	-	
	e.	VEC	-	-	-	-	-	0
	f.	FP/CES	Project	100239	Apiculture- on-job training	2	4	4
		CC	-	-	-	-	-	-
		TOTAL				22	34	34

Sant Gadge Baba Amravati University, Amravati
FACULTY: SCIENCE AND TECHNOLOGY
Teaching and Learning Scheme: for the Degree of Bachelor of Apiculture
Syllabus for Courses B.Sc. III Semester-VI

Theory Major:10 Bee Diseases and Their Management

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100229	VI	Theory Major: Bee Diseases and Their Management	02	30	02	Ext-30 Int-20

Course Objectives	1. To understand major diseases affecting honeybee colonies. 2. To identify symptoms, causes, transmission, and preventive measures of bee diseases. 3. To develop skills in diagnosis and scientific management of bee diseases. 4. To promote healthy colony management and sustainable apiculture practices.			
Course Outcome	After completion of the course, students will be able to: CO-1. Identify important honeybee diseases and their symptoms. CO-2-Explain disease transmission and epidemiology in apiaries. CP-3. Apply scientific methods for disease prevention and management. CO-4. Perform basic disease diagnosis and sample handling. CO-5.Adopt hygienic and sustainable bee health management practices.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Introduction to Honeybee Health; 1.1. Factors affecting colony health 1.2.Types of bee diseases: bacterial, viral, fungal, and protozoan 1.3. Disease transmission in apiaries. 1.4. Role of hygiene and sanitation in disease prevention	8	8	Lecture Method ☐ Demonstration Method ☐ Practical and Laboratory Training ☐ Field Visits ☐ Problem-Based Learning (PBL) ☐ Experiential Learning ☐ Project-Based Learning ☐ Group Discussion and Seminar ☐ ICT-Enabled Teaching ☐ Collaborative Learning ☐ Inquiry-Based Learning. ☐ Skill-Oriented Training ☐ Extension and Community Interaction
Unit-II	Bacterial and Viral Diseases: 2.1-American Foulbrood (AFB) 2.2-European Foulbrood (EFB) 2.3-Sacbrood disease , Thai Sac Brood Virus 2.4-Paralysis disease in honeybees Symptoms, diagnosis, prevention, and management.	7	7	
Unit-III	Fungal and Protozoan Diseases 3.1-Chalkbrood disease . 3.2-Stonebrood disease. Nosema disease. 3.3-Causative organisms and life cycle . 3.4-Diagnosis and integrated disease management	8	8	
Unit-IV	Disease Diagnosis and Integrated Health Management: 4.1-Field diagnosis techniques. 4.2-Collection and preservation of diseased samples. 4.3-Hygienic apiary management practices.	7	7	

	4.4- Use of resistant bee strains & Integrated bee health management approaches			
References: 1. Honey Bee Pathology – Standard reference on diseases, pathogens, diagnosis, and management of honeybee diseases. 2. The Beekeeper’s Handbook – Practical guide covering colony health, diseases, pests, and preventive management. 3. ABC and XYZ of Bee Culture – Comprehensive encyclopedia on apiculture including bee diseases and their control. 4. Honeybee Diseases and Pests: A Practical Guide – Illustrated practical manual for identification and management of bee diseases and pests. 5. Asian Apicultural Association Manual of Beekeeping – Includes sections on disease diagnosis, prevention, and apiary sanitation. 6. Beekeeping: A Practical Guide – Practical management strategies for maintaining healthy bee colonies. 7. First Lessons in Beekeeping – Introductory text on colony management, diseases, and bee health. 8. The Hive and the Honey Bee – Detailed scientific and practical reference on bee biology, diseases, and apiary management. 9. Diagnosis and Treatment of Honey Bee Diseases – Diagnostic manual for major honeybee diseases and treatment methods. 10. Food and Agriculture Organization (FAO) Beekeeping Resources – International manuals and technical resources on bee health management. 11. National Bee Board, India – Indian resources, training manuals, and extension publications related to apiculture and bee disease management. 12. Khadi and Village Industries Commission (KVIC) – Technical literature and training materials on beekeeping and colony health. 13. Central Bee Research and Training Institute (CBRTI) – Research and training resources related to bee disease diagnosis and management. 14. Honey Bee Diseases and Their Management – Indian perspective on major diseases affecting honeybee colonies. 15. ☐ Practical Manual of Apiculture – Laboratory and field-oriented exercises related to bee diseases and colony health monitoring.				
Model Questions				
Short Type: 1. Define honeybee disease and mention its importance in apiculture. 2. What are the symptoms of American Foulbrood disease? 3. Differentiate between American Foulbrood and European Foulbrood. 4. What is Nosema disease in honeybees? 5. Name any four viral diseases of honeybees. 6. What are the major causes of disease spread in apiaries? 7. Explain the role of apiary sanitation in disease prevention. 8. What is Chalkbrood disease and how does it affect bee colonies?				
Long Type: 1. Describe the causes, symptoms, transmission, and management of American Foulbrood disease in honeybees. 2. Explain fungal and protozoan diseases of honeybees with suitable examples and management practices. 3. Discuss the various methods used for diagnosis and integrated management of honeybee diseases. 4. Write detailed notes on viral diseases of honeybees and their preventive measures.				
MCQ 1. American Foulbrood disease is caused by: a) Virus, b) Fungus, c) Bacterium, d) Protozoa Answer: c) Bacterium 2. Nosema disease is caused by: a) Protozoa, b) Virus, c) Algae, d) Nematode Answer: a) Protozoa 3. Chalkbrood disease is a: a) Viral disease, b) Bacterial disease, c) Fungal disease, d) Nutritional disorder Answer: c) Fungal disease				

4. Which disease affects the brood of honeybees?
a) Sacbrood, b) Nosema, c) Paralysis, d) Dysentery
Answer: a) Sacbrood
5. The causative organism of American Foulbrood is:
a) Paenibacillus larvae, b) Nosema apis, c) Ascosphaera apis, d) Varroa destructor
Answer: a) Paenibacillus larvae
6. Which of the following helps prevent disease spread in apiaries?
a) Poor sanitation, b) Overcrowding, c) Sterilization of equipment, d) Mixing infected colonies
Answer: c) Sterilization of equipment
7. Sacbrood disease is caused by:
a) Fungus, b) Virus, c) Bacterium, d) Mite
Answer: b) Virus
8. Which one is a fungal disease of honeybees?
a) Nosema, b) Paralysis, c) Chalkbrood, d) Sacbrood
Answer: c) Chalkbrood

Rubric for Internal Assessment for Theory Paper

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- SEMESTER – VI (NEP) Theory Major:10 Bee Diseases and Their Management		
Code:100229		Max Marks: 20
Sr. No.	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05

Major Theory-11: Bee Pests, Predators, and Enemy Management

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100230	VI	Major Theory-11: Bee Pests, Predators, and Enemy Management	02	30	02	Ext-30 Int-20

Course Objectives	- To study major pests, predators, and enemies of honeybees. - To understand their biology, nature of damage, and economic importance. - To develop practical knowledge for integrated pest and predator management. - To promote colony protection and sustainable beekeeping.			
Course Outcome	After completion of the course, students will be able to: CO-1. Identify important pests, predators, and enemies of honeybees. CO-2. Explain the biology and damage caused by bee enemies. CO-3. Apply integrated pest and predator management techniques. CO-4. Protect colonies using scientific and eco-friendly approaches. CO-5. Develop skills for maintaining healthy and productive apiaries.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Introduction to Bee Pests and Predators 1.1-Concept and classification of bee enemies. 1.2-Economic importance of pests and predators. 1.3-Factors favouring pest infestation in apiaries . 1.4-Integrated pest management principles in beekeeping.	8	8	Lecture Method ☐ Demonstration Method ☐ Practical and Laboratory Training ☐ Field Visits / Apiary-Based Learning ☐ Problem-Based Learning (PBL) ☐ Experiential Learning ☐ Project-Based Learning ☐ Group Discussion and Seminar ☐ ICT-Enabled Teaching ☐ Collaborative Learning ☐ Inquiry-Based Learning. ☐ Skill-Oriented Training ☐ Extension and Community Interaction
Unit-II	Wax Moths and Mite Pests: 2.1-Greater wax moth and lesser wax moth. 2.2-Biology and damage symptoms. 2.3-Varroa mite infestation Tpilaelaps mites. 2.4-Detection, prevention, and management practices	7	7	
Unit-III	Predators and Vertebrate Enemies: 3.1-Wasps and hornets . 3.2-Ants and termites . 3.3-Birds attacking honeybees. 3.4-Lizards, spiders, frogs, and rodents. 3.5-Bears and other mammalian enemies and Colony protection measures.	8	8	

Unit-IV	Integrated Management of Bee Enemies: 4.1-Cultural and mechanical control methods. 4.2-Biological control approaches 4.3-Safe chemical management practices & Apiary sanitation and monitoring 3.4-Seasonal management strategies & Sustainable and eco-friendly protection measures.	7	7	
1. References 1. Honey Bee Pathology – Standard reference on diseases, pathogens, diagnosis, and management of honeybee diseases. 2. The Beekeeper's Handbook – Practical guide covering colony health, diseases, pests, and preventive management. 3. ABC and XYZ of Bee Culture – Comprehensive encyclopedia on apiculture including bee diseases and their control. 4. Honeybee Diseases and Pests: A Practical Guide – Illustrated practical manual for identification and management of bee diseases and pests. 5. Asian Apicultural Association Manual of Beekeeping – Includes sections on disease diagnosis, prevention, and apiary sanitation. 6. Beekeeping: A Practical Guide – Practical management strategies for maintaining healthy bee colonies. 7. First Lessons in Beekeeping – Introductory text on colony management, diseases, and bee health. 8. The Hive and the Honey Bee – Detailed scientific and practical reference on bee biology, diseases, and apiary management. 9. Diagnosis and Treatment of Honey Bee Diseases – Diagnostic manual for major honeybee diseases and treatment methods. 10. Food and Agriculture Organization (FAO) Beekeeping Resources – International manuals and technical resources on bee health management. 11. National Bee Board, India – Indian resources, training manuals, and extension publications related to apiculture and bee disease management. 12. Khadi and Village Industries Commission (KVIC) – Technical literature and training materials on beekeeping and colony health. 13. Central Bee Research and Training Institute (CBRTI) – Research and training resources related to bee disease diagnosis and management. 14. Honey Bee Diseases and Their Management – Indian perspective on major diseases affecting honeybee colonies. 15. Practical Manual of Apiculture – Laboratory and field-oriented exercises related to bee diseases and colony health monitoring.				
Model Questions Short Type: 1. Define bee pests and predators. 2. What are the harmful effects of wax moths in bee colonies? 3. Write short notes on Varroa mites. 4. How do ants damage honeybee colonies? 5. Name any four predators of honeybees. 6. What are the symptoms of mite infestation in bee colonies? 7. Explain the importance of integrated pest management in apiculture. 8. What preventive measures are used against wasps and hornets in apiaries? Long Answer Questions 1. Describe the biology, nature of damage, and management of wax moths in honeybee colonies. 2. Explain the economic importance, symptoms, and integrated management of Varroa mite infestation in honeybees. 3. Discuss various predators and vertebrate enemies of honeybees and methods for colony protection.				

4. Explain integrated pest, predator, and enemy management practices used in modern beekeeping.
- 5.

Multiple Choice Questions

1. The major pest that damages old honeycombs is:
a) Ant, b) Wax moth, c) Hornet, d) Termite, **Answer:** b) Wax moth
2. Varroa destructor is a:
a) Fungus, b) Bacterium, c) Mite, d) Virus
Answer: c) Mite
3. Which insect commonly attacks and kills honeybees near the hive?
a) Butterfly, b) Dragonfly, c) Hornet, d) Grasshopper
Answer: c) Hornet
4. Ants are considered:
a) Pollinators, b) Predators and pests, c) Bee diseases, d) Beneficial insects
Answer: b) Predators and pests
5. Which pest feeds on wax, pollen, and comb material?
a) Wax moth, b) Louse, c) Beetle, d) Aphid
Answer: a) Wax moth
6. A common vertebrate enemy of honeybees is:
a) Frog, b) Fish, c) Rabbit, d) Deer
Answer: a) Frog
7. The best method to reduce pest infestation in apiaries is:
a) Poor sanitation, b) Overcrowding, c) Hygienic management, d) Ignoring infected colonies
Answer: c) Hygienic management.
8. Which of the following is used in integrated pest management?
a) Monitoring and sanitation, b) Destruction of all colonies, c) Excessive pesticide use, d) Avoiding hive inspection
Answer: a) Monitoring and sanitation .

Rubric for Internal Assessment for Theory Paper

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI			
Internal Assessment			
B.Sc. Part III- SEMESTER – VI (NEP)			
Major Theory-11: Bee Pests, Predators, and Enemy Management			
Code:100230		Max Marks: 20	
Sr. No.	Assessment Criteria	Marks	
1	Attendance	05	
2	Class Assignments	05	
3	Unit Test - MCQ	05	
4	Participation in Activity/ Field visit	05	

Theory Major-12 Composition & Quality of Honey.

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100231	VI	Theory Major-12 Composition & Quality of Honey.	02	30	02	Ext-30 Int-20

Course Objectives	- Understand the composition, properties, and nutritional value of honey. - Explain quality standards of honey according to Food Safety and Standards Authority of India (FSSAI). - Demonstrate scientific methods of honey extraction, processing, and storage. - Identify appropriate packaging and labeling methods for honey products. - Develop basic branding and marketing strategies for commercial honey sales. - Understand value addition and different uses of honey in food, medicine, and cosmetics.			
Course Outcome	After successful completion of the course, students will be able to: CO-1. Describe the composition and nutritional importance of honey. CO-2. Apply FSSAI quality standards for honey testing and evaluation. CO-3. Perform basic honey processing, storage, and packaging operations. CO-4. Identify adulterated and poor-quality honey samples. CO-5. Design suitable branding and marketing strategies for honey products. CO-6. Develop entrepreneurial skills related to honey production and marketing.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Composition, Properties & Uses of Honey 1.1. Definition and origin of honey 1.2. Physical and chemical composition of honey, 1.3. Sugars, moisture, enzymes, minerals, vitamins, acids, proteins 1.4. Types of honey and floral sources, Nutritional and medicinal properties of honey 1.5. Industrial and household uses of honey 1.6. Importance of honey in Ayurveda, food, cosmetics, and pharmaceuticals	8	8	☐ Lecture Method ☐ Demonstration Method ☐ Practical and Laboratory Training ☐ Field Visits / Apiary-Based Learning ☐ Problem-Based Learning (PBL) ☐ Experiential Learning ☐ Project-Based Learning ☐ Group Discussion and Seminar ☐ ICT-Enabled Teaching
Unit-II	Introduction to Food Safety and Standards Authority of India 2.1. Regulations for honey Standards for: Moisture content, Sucrose percentage, Reducing sugars, Acidity and HMF 2.2. Pollen content and purity, Adulteration in honey and detection methods 2.3. Quality testing and certification procedures 2.4. Hygienic handling and food safety measures 2.5. AGMARK and export quality requirements	7	7	

Unit-III	Honey Processing, Storage & Packaging 3.1. Honey extraction methods Filtration, straining, and moisture reduction 3.2. Heating and pasteurization of honey, Prevention of fermentation and granulation 3.3. Storage methods and precautions 3.4. Packaging materials: Glass bottles Food-grade plastic containers Sachets and jars Labelling requirements under FSSAI Shelf life and transportation of honey	8	8	
Unit-IV	Branding & Marketing of Honey 4.1. Concept of honey branding. Brand name, logo, and product identity. 4.2. Packaging design and consumer appeal. 4.3. Marketing channels: Local markets. Retail stores, Cooperatives, Online marketing., 4.4. Pricing and promotion strategies 4.5. Value-added honey products: Flavoured honey, Comb honey Herbal honey. Entrepreneurship opportunities in beekeeping and honey business Export potential of Indian honey	7	7	

References:

1. Honey: Composition, Properties and Health Benefits – Edited by N. N. Al-Waili, K. Salom, and G. Butler. Provides detailed information on honey composition, physicochemical properties, and quality parameters.
 2. Honey Analysis – Comprehensive reference covering analytical methods used for determining honey quality and authenticity.
 3. The Honey Handbook – Covers honey production, composition, quality assessment, storage, and uses.
 4. Honey Bee Products: Properties, Applications and Apitherapy – Includes chapters on honey composition, nutritional value, quality standards, and applications.
 5. Honey and Healing – Discusses honey constituents, medicinal properties, and factors affecting quality.
 6. The ABC and XYZ of Bee Culture – Classic beekeeping reference containing sections on honey composition, grading, and quality evaluation.
 7. Honeybee Products for Health and Prosperity – Covers honey chemistry, quality characteristics, processing, and value addition.
 8. Beekeeping in India – Includes practical information on honey production, composition, harvesting, and quality control in Indian conditions.
 9. Honey Quality, Processing and International Regulatory Standards – Important resource on international standards, quality testing, and honey authentication.
 10. The Hive and the Honey Bee – Authoritative text covering honey production, chemical composition, quality evaluation, storage, and marketing.
- [National Bee Board \(India\)](#)
 - [Food Safety and Standards Authority of India \(FSSAI\) Honey Standards](#)
 - [International Honey Commission](#)
 - [FAO Beekeeping Resources](#)

Model Questions
Short Type: 1. Define honey according to Food Safety and Standards Authority of India standards. 2. What are the major sugar components present in honey? 3. What is the permissible moisture content in quality honey as per FSSAI? 4. Define honey adulteration. 5. What is meant by HMF in honey testing? 6. Mention any two medicinal uses of honey. 7. What is granulation in honey? 8. Name any two materials used for honey packaging. 9. What information should be included on a honey label under FSSAI regulations? 10. What is branding in honey marketing?
Long Type: 1. Explain the composition of honey and discuss the role of sugars, enzymes, minerals, vitamins, and moisture in determining honey quality. 2. Describe the quality standards of honey prescribed by Food Safety and Standards Authority of India. Explain the importance of moisture, sucrose, reducing sugars, acidity, and HMF in honey evaluation. 3. Discuss different types of honey adulteration and explain various methods used for detection of adulterated honey. 4. Explain the nutritional, medicinal, and industrial uses of honey in detail. 5. Describe the complete process of honey extraction, filtration, processing, and storage for maintaining honey quality. 6. What are the causes of fermentation and granulation in honey? Explain the preventive measures used during processing and storage. 7. Discuss different packaging materials used for honey and explain the precautions necessary during packaging and transportation. 8. Explain the labeling requirements for honey products under FSSAI regulations. Why is proper labeling important in honey marketing? 9. Describe the role of branding and attractive packaging in promoting honey products in local and international markets. 10. Discuss various marketing channels and entrepreneurship opportunities available in honey production, value addition, and export business.
MCQ 1. The major sugar present in honey is: a) Sucrose, b) Lactose, c) Fructose, d) Maltose 2. According to Food Safety and Standards Authority of India, excess moisture in honey may lead to: a) Crystallization, b) Fermentation, c) Dark colour, d) Increased viscosity 3. HMF in honey is mainly used as an indicator of: a) Purity and overheating, b) Floral source, c) Colour, d) Wax content 4. Which of the following is commonly used for honey packaging? a) Iron container, b) Copper vessel, c) Glass bottle, d) Cement bag 5. Honey adulteration means: a) Improving honey quality, b) Mixing impurities or sugar syrup with honey, c) Filtering honey, d) Heating honey 6. Which process is used to remove suspended particles from honey? a) Fermentation, b) Filtration, c) Granulation, d) Crystallization 7. The medicinal property of honey is mainly due to its: a) High moisture, b) Antimicrobial nature, c) High fat content, d) Starch content 8. Which of the following information is essential on a honey label? a) Vehicle number, b) Batch number, c) Farmer's photograph, d) Hive colour 8. Attractive packaging of honey mainly helps in: a) Reducing sweetness, b) Increasing fermentation, c) Better marketing and consumer appeal, d) Increasing moisture 9. Which of the following is a value-added honey product? a) Herbal honey, b) Stone honey, c) Sand honey, d) Synthetic honey

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- SEMESTER – VI (NEP)		
Code:100231	Theory Major-12:Composition & Quality of Honey	Max Marks: 20
Sr. No.100231	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05

Practical : Theory Major-10,11 &12

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100232	VI	Lab/Practical : Major-10,11 &12	02	60	04	Ext.25+ Int. 25

Course Objectives	1. To identify major honey bee diseases and their symptoms through practical observation. 2. To develop skills in disease diagnosis, colony inspection, and sample collection. 3. To understand preventive and management measures for maintaining healthy bee colonies. 4. To study important pests, predators, and enemies of honey bees and their identification. 5. To train students in monitoring and control techniques for bee enemies. 6. To develop practical understanding of integrated pest and enemy management in apiaries. 7. To study the chemical composition and physicochemical properties of honey. 8. To train students in laboratory methods for assessing honey quality and purity. 9. ☐ To develop practical skills in honey sampling, testing, and quality evaluation.
Course Outcome	After the completion of this course student will be able to- 1. Recognize common bee diseases affecting apiaries. 2. Demonstrate practical skills in disease monitoring and management. 3. Apply appropriate sanitary and preventive practices in beekeeping operations. 4. Identify major bee pests, predators, and enemies in field conditions. 5. Perform suitable preventive and control measures against bee enemies. 6. Apply integrated management practices for protecting bee colonies. 7. Analyze important quality parameters of honey such as moisture, acidity, and sugar content. 8. Perform standard laboratory tests for honey quality assessment. 9. Evaluate honey samples for purity and quality according to standard guidelines.
List of Experiment/ Exercise	
Experiments based on Bee diseases, pest, and enemies: 1. Observation of brood pattern, adult bee activity, colony strength, and symptoms of common bee diseases. 2. Study of Symptoms of American Foulbrood (AFB): Examination of infected brood combs for ropy larval remains, sunken capping, and foul smell. 3. Study of Symptoms of European Foulbrood (EFB): Identification of twisted larvae, irregular brood pattern, and discoloured brood in infected colonies. 4. Detection of Nosema Disease in Honey Bees Identification of Chalkbrood Disease: Observation and collection of mummified larvae affected by fungal infection. 5. Study of Sac brood Disease Symptoms : Identification of sac-like dead larvae and characteristic brood symptoms. 6. Microscopic Examination of Bee Pathogens: Preparation of temporary slides for observation of fungal spores, bacteria, and protozoan pathogens. 7. Assessment of Colony Hygiene Behaviour: Evaluation of hygienic behaviour in bee colonies by observing removal of diseased or dead brood.	

8. **Sanitation Practices in Apiary Management:** Demonstration of hive cleaning, disinfection of equipment, and safe disposal of infected materials.
9. **Preparation and Use of Disinfectant Solutions in Apiaries:** Preparation of suitable disinfectants for sterilization of hive tools and bee boxes.
10. **Inspection and Record Keeping of Bee Diseases:** Maintenance of field records related to disease occurrence, colony condition, and treatment measures.
11. **Study of Environmental Factors Affecting Bee Diseases :** Observation of the influence of temperature, humidity, nutrition, and sanitation on disease incidence.
12. **Demonstration of Quarantine and Isolation Practices:** Methods for separating infected colonies to prevent spread of diseases within the apiary.
13. **Preparation of Apiary Health Monitoring Report :** Field-based survey and preparation of a report on disease prevalence and colony health status.
14. **Field Survey of Common Bee Diseases in Local Apiaries:** Visit to nearby apiaries for identification and documentation of disease symptoms and management practices.
15. **Awareness Exercise on Prevention of Disease Spread:** Preparation of charts/posters/models showing preventive measures for maintaining healthy colonies.

Experiments based on Honey :

1. **Determination of Moisture Content in Honey:** Measurement of moisture percentage using refractometer and comparison with Food Safety and Standards Authority of India standards.
2. **Test for Honey Adulteration:** Detection of adulterants such as sugar syrup, starch, or water in honey samples using simple laboratory methods.
3. **Determination of pH and Acidity of Honey:** Measurement of acidity level of honey and interpretation of results for quality assessment.
4. **Estimation of Reducing Sugars in Honey:** Laboratory estimation of glucose and fructose content in honey samples.
5. **Study of Honey Processing Techniques:** Demonstration of honey extraction, filtration, straining, and heating methods.
6. **Observation of Fermentation and Granulation in Honey:** Identification of causes and preventive measures related to fermentation and crystallization.
7. **Packaging Exercise for Honey Products:** Practice in filling, sealing, and packing honey in glass jars, plastic containers, and sachets.
8. **Preparation of Honey Labels as per FSSAI Guidelines:** Designing labels containing product name, net weight, batch number, manufacturing date, expiry date, and FSSAI license number.
9. **Branding and Marketing Exercise for Honey Products:** Development of a brand name, logo, packaging design, and marketing strategy for commercial honey sales

References/E-Contents / E-Books /Digital Resources / Web Links:

- [Food and Agriculture Organization \(FAO\) – Beekeeping and Bee Health Resources](#)
Comprehensive digital resources on honey bee diseases, pests, colony management, and apiculture practices.
- The Hive and the Honey Bee – Dadant Publishing
Standard reference book covering honey bee diseases, parasites, predators, and colony health management.
- [Bee Health – Scientific Beekeeping by Randy Oliver](#)
Practical and research-based articles on bee diseases, Varroa mites, Nosema, and integrated pest management.
- [Honey Bee Health Coalition](#)
Digital manuals and best management practices for controlling bee pests and diseases.

□ The University of Minnesota Bee Lab Educational resources, disease identification guides, and practical beekeeping manuals. □ NC State Apiculture Program Extension publications and practical guides on honey bee diseases, enemies, and colony inspection. □ Bee Informed Partnership Online educational resources for monitoring colony losses, pests, and disease management. □ Integrated Pest Management for Beekeeping – SARE Practical e-book/manual on integrated pest and disease management in honey bees. □ ICAR-Central Bee Research and Training Institute (CBRTI) Indian reference source for honey bee disease diagnosis, enemies, and practical training manuals. □ University of Florida Honey Bee Research and Extension Lab Open-access manuals, disease diagnosis sheets, and practical resources on bee enemies and apiary management.
1. Codex Alimentarius – Standard for Honey International standards and quality parameters for honey composition, purity, moisture, sugars, and adulteration testing. 2. National Honey Board – Honey Quality and Testing Resources Educational materials on honey composition, nutritional value, processing, and quality evaluation. 3. The Honey Bee Research Centre – Honey Composition Guide Digital resources on honey chemistry, floral origin, quality assessment, and laboratory practices. 4. ICAR-Central Bee Research and Training Institute (CBRTI) Indian practical manuals and training resources related to honey quality analysis and bee products. 5. Bee Health and Honey Quality Resources – University of Florida Laboratory guides and extension publications on honey quality parameters and testing methods. 6. AOAC International – Official Methods of Analysis Standard analytical procedures for determination of moisture, acidity, sugars, and HMF in honey. 7. Food Safety and Standards Authority of India (FSSAI) – Honey Standards Regulatory standards and laboratory quality requirements for honey in India. 8. Apimondia – International Federation of Beekeepers’ Associations Research publications and technical materials on honey composition, authenticity, and quality control. 9. Honey Quality, Methods of Analysis and International Regulatory Standards Review Open-access scientific review covering physicochemical composition and quality analysis of honey. 10. FAO Beekeeping and Honey Processing Manual Practical e-manual on honey harvesting, processing, storage, and quality maintenance.

Assessment Rubric for Internal Assessment for Major Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Apiculture) SEMESTER – VI (NEP)	
Code: 100232	Lab: Major-10,11 & 12	Max Marks: 25
Sr. No.	Assessment Criteria	Marks
1	Participation in activities	05
2	Practical Book	05
3	MCQ	10
4	Attendance	05

Assessment Rubric for External Assessment for Practical

E	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Assessment for Lab Work B.Sc.III (Apiculture) SEMESTER –VI (NEP)	
Course Code: 100232	Lab: Major-10,11 & 12	Max Marks: 25, Time: 4Hours
Sr. No.	Assessment Criteria	Marks
1	Experiments based on bee diseases	08
2	Experiments based on bee pest	06
3	Experiments based on bee enemies	06
4	Viva-voce	05

Elective-3: *Apis dorsata* (Rock bee) – Honey Harvesting and conservation

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100233	VI	Elective-3: <i>Apis dorsata</i> (Rock bee) – Honey Harvesting and conservation	02	30	02	Ext-30 Int-20

Course Objectives	1. To understand the biology and ecology of <i>Apis dorsata</i>. 2. To study traditional and scientific honey harvesting methods. 3. To promote sustainable and conservation-oriented harvesting practices. 4. To develop knowledge about the economic and ecological importance of rock bees.			
Course Outcome	After completion of course, learner is able to – CO1-Explain the taxonomy, morphology, biology, ecology, and behavioral characteristics of <i>Apis dorsata</i> and its ecological importance in natural and agricultural ecosystems. CO2-Identify nesting habitats, foraging patterns, migration behavior, and environmental factors affecting the survival and distribution of rock bees. CO3-Demonstrate knowledge of traditional and scientific honey harvesting methods, tools, equipment, and safety precautions used in rock bee honey collection. CO4-Apply sustainable and non-destructive honey harvesting techniques for conservation-oriented utilization of wild honey bee colonies. CO5-Analyze the composition, quality parameters, nutritional value, processing, storage, and marketing aspects of rock bee honey and related bee products. CO6-Evaluate major threats to <i>Apis dorsata</i> populations, including habitat destruction, pesticides, climate change, and destructive harvesting practices. CO7-Recommend suitable conservation and management strategies for protection and sustainable utilization of <i>Apis dorsata</i> and its nesting habitats. CO8-Develop entrepreneurial and community-based approaches for forest honey production, value addition, eco-friendly honey enterprises, and rural livelihood enhancement.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	1.1 Traditional honey harvesting. 1.2 Scientific. and sustainable harvesting. 1.3 Tools and equipment. 1.4 Safety measures	8	8	☐ Lecture Method ☐ Demonstration Method ☐ Practical and Laboratory Training ☐ Field Visits / Apiary-Based Learning
Unit-II	2.1 Honey extraction and processing. 2.2 Composition and quality of honey. 2.3 Value-added products 2.4 Marketing and entrepreneurship.	7	7	
Unit-III	3.1. Threats to rock bee populations. 3.2 Conservation strategies. 3.3 Policies and legal aspects. 3.4 Future prospects and research	8	8	

Unit-IV	4.1 Role in pollination and biodiversity conservation 4.2 Importance in forest ecosystems and agriculture . 4.3 Threats to wild rock bee populations. 4.4 Rock bee and Melghat forest.	7	7	
References: 1. The Hive and the Honey Bee 2. Asian Honey Bees 3. Beekeeping in India 4. Honeybees and their Management 5. Food and Agriculture Organization publications on sustainable honey harvesting 6. National Bee Board manuals and reports on beekeeping and honey production				
Model Questions				
Short Type: 1. Define <i>Apis dorsata</i> and mention its important identifying characteristics. 2. What are the major nesting habitats of rock bees? 3. Explain the ecological role of <i>Apis dorsata</i> in pollination. 4. What is sustainable honey harvesting? 5. List any four tools used in rock bee honey collection. 6. Mention the major safety precautions during honey harvesting from wild bee colonies. 7. What are the common causes of decline in <i>Apis dorsata</i> populations? 8. State the importance of conservation of rock bees in forest ecosystems.				
Long Type: 1. Describe the biology, nesting behavior, colony organization, and ecological importance of <i>Apis dorsata</i> in natural and agricultural ecosystems. 2. Explain traditional and scientific methods of honey harvesting from rock bee colonies. Discuss the tools, safety measures, and sustainable harvesting practices involved. 3. Discuss the processing, quality evaluation, storage, packaging, and marketing of rock bee honey and other bee products. 4. Examine the major threats to <i>Apis dorsata</i> populations and suggest suitable conservation and sustainable management strategies for protecting wild honey bees and their habitats.				
MCQ 1. <i>Apis dorsata</i> is commonly known as: a) Italian bee, b) Little bee, c) Rock bee, d) Stingless bee 2. <i>Apis dorsata</i> generally builds its nest: a) Inside wooden hives, b) Underground, c) On open cliffs and tall trees d) Inside soil cavities 3. The major role of <i>Apis dorsata</i> in ecosystems is: a) Soil formation, b) Pollination, c) Nitrogen fixation ,d) Seed storage 4. Sustainable honey harvesting mainly aims to: a) Destroy entire colonies, b) Collect brood combs only, c) Protect bee colonies while collecting honey, d) Reduce honey quality 5. Which of the following is commonly used during honey harvesting? a) Smoker, b) Microscope, c) Centrifuge, d) Incubator 6. One major threat to <i>Apis dorsata</i> populations is: a) Afforestation, b) Habitat destruction, c) Organic farming, d) Pollination services 7. Rock bee honey is valued mainly for its: a) Metallic content, b) Nutritional and medicinal properties, c) High starch content d) Artificial flavor 8. Conservation of <i>Apis dorsata</i> helps in: a) Reducing biodiversity, b) Increasing pollution, c) Maintaining ecological balance d) Eliminating wild plants				

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- SEMESTER – VI (NEP)		
Code:100233	Elective-3: Apis dorsata (Rock bee) – Honey Harvesting and conservation	Max Marks: 20
Sr. No.	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05

Practical Elective-3 *Apis dorsata* (Rock bee) – Honey Harvesting and conservation

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100234	VI	Practical Elective-3 <i>Apis dorsata</i> (Rock bee) – Honey Harvesting and conservation	02	60	04	Ext.25+ Int. 25

Course Objectives	1. To introduce students to the biology, ecology, and behavior of <i>Apis dorsata</i> (Rock Bee). 2. To develop understanding of natural nesting habitats and seasonal activities of rock bees. 3. To familiarize students with traditional and scientific methods of honey harvesting. 4. To impart practical knowledge of safe, hygienic, and sustainable honey collection techniques. 5. To study the ecological and economic importance of <i>Apis dorsata</i> in pollination and honey production. 6. To create awareness about threats to rock bee populations such as habitat destruction, pesticide exposure, and overharvesting. 7. To train students in conservation strategies and sustainable management of wild honey bee resources. 8. To encourage community participation and indigenous knowledge integration in rock bee conservation programs.
Course Outcome	After successful completion of the course, students will be able to: CO1-Explain the taxonomy, biology, ecology, and nesting behavior of <i>Apis dorsata</i>. CO2-Identify natural habitats, floral resources, and seasonal migration patterns of rock bees. CO3-Demonstrate traditional and modern honey harvesting techniques with safety precautions. CO4-Apply hygienic methods for honey extraction, processing, and storage. CO5-Differentiate between sustainable and destructive honey harvesting practices. CO6-Assess the ecological role and economic significance of <i>Apis dorsata</i> in biodiversity conservation and pollination. CO7-Analyze major threats affecting rock bee populations and recommend suitable conservation measures. CO8-Design sustainable honey harvesting and conservation management plans for <i>Apis dorsata</i> populations.
List of Experiment/ Exercise	
1. Field identification and ecological observation of <i>Apis dorsata</i> colonies. 2. Study of nesting behavior and colony distribution of rock bees in natural habitats. 3. Observation and documentation of traditional honey harvesting methods used by local honey hunters. 4. Demonstration of scientific and sustainable honey harvesting techniques for <i>Apis dorsata</i>. 5. Comparative study of destructive and non-destructive honey harvesting practices. 6. Assessment of colony defensive behaviour during honey harvesting operations. 7. Extraction, filtration, and hygienic handling of rock bee honey. 8. Estimation of honey yield and wax recovery from <i>Apis dorsata</i> colonies. 9. Identification and documentation of floral resources supporting rock bee populations. 10. Preparation of a conservation and management plan for sustainable utilization of <i>Apis dorsata</i>.	
References/E-Contents / E-Books /Digital Resources / Web Links:	
Reference Books	

1. Crane, E. (1999). *The World History of Beekeeping and Honey Hunting*. Routledge, London.
2. Free, J.B. (1981). *Biology and Ecology of Honey Bees*. Academic Press, London.
3. Morse, R.A. & Hooper, T. (1985). *The Illustrated Encyclopedia of Beekeeping*. Blandford Press, UK.
4. Oldroyd, B.P. & Wongsiri, S. (2006). *Asian Honey Bees: Biology, Conservation and Human Interactions*. Harvard University Press, USA.
5. Seeley, T.D. (1995). *The Wisdom of the Hive*. Harvard University Press, Cambridge.
6. Singh, S. (1962). *Beekeeping in India*. Indian Council of Agricultural Research (ICAR), New Delhi.
7. Gupta, R.K. (2014). *Beekeeping for Rural Development*. Scientific Publishers, Jodhpur.
8. Mishra, R.C. (1995). *Honey Bees and Their Management in India*. ICAR Publication, New Delhi.
9. Wongsiri, S. (1992). *Biology and Management of Honey Bees in Asia*. Faculty of Science, Chulalongkorn University, Thailand.
10. Williams, I.H. (1994). *Bee World and Pollination Ecology*. IBRA Publications, UK.

E-Contents / E-Books / Digital Resources

FAO: Harvesting Honey from Giant Honey Bees

Practical guidelines on honey harvesting, processing, and hygienic handling of *Apis dorsata* honey.

MDPI Insects: Conservation of Giant Honey Bee (*Apis dorsata*)

Research article discussing conservation strategies, nesting ecology, sustainable pollination services, and safe handling techniques for *Apis dorsata*.

PubMed: Conservation of Giant Honey Bee (*Apis dorsata*)

Scientific publication focusing on conservation, domestication approaches, and sustainable management of giant honey bees.

Frontiers in Bee Science: Socio-ecological Surveys of *Apis dorsata*

Study on ecology, indigenous knowledge, nesting behavior, and conservation in the Nilgiri Biosphere Reserve, India.

Biodiversity Science: Threat Factors and Conservation Strategies for *Apis dorsata*

Review article covering biology, threats, habitat destruction, and conservation strategies for giant honey bees.

ResearchGate: Conservation of Asian Giant Honeybee (*Apis dorsata*)

Research resource discussing sustainable harvesting methods and conservation needs of rock bees.

Useful Web Resources

1. [Food and Agriculture Organization \(FAO\)](#)
2. [International Bee Research Association \(IBRA\)](#)
3. [Indian Council of Agricultural Research \(ICAR\)](#)
4. [National Bee Board, India](#)
5. [Frontiers in Bee Science Journal](#)
6. [PubMed Scientific Database](#)
7. [ResearchGate Scientific Community](#)
8. [Google Scholar](#)

Assessment Rubric for Internal Assessment for Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Apiculture) SEMESTER – VI (NEP)	
Code: 100234	Lab: Elective-3: <i>Apis dorsata</i> (Rock bee) – Honey Harvesting and conservation	Max Marks: 25
Sr. No.	Assessment Criteria	Marks
1	Participation in activities	05
2	Practical Book	05
3	MCQ	10
4	Attendance	05

Assessment Rubric for External Assessment for Practical

E	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Assessment for Lab Work B.Sc.III (Apiculture) SEMESTER –VI (NEP)	
Course Code: 100234	Lab: Elective-3: <i>Apis dorsata</i> (Rock bee) – Honey Harvesting and conservation	Max Marks: 25, Time: 4Hours
Sr. No.	Assessment Criteria	Marks
1	Experiment Major	10
2	Experiment Minor	05
3	Field Report	05
4	Viva-voce	05

Elective -4: Advance Processing, value addition and Quality management of Honey Bee Product

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100235	VI	Elective -4: Advance Processing, value addition and Quality management of Honey Bee Product	02	30	02	Ext-30 Int-20

Course Objectives	- To provide advanced knowledge of processing techniques for honey bee products such as honey, beeswax, pollen, propolis, royal jelly, and bee venom. - To develop practical skills in value addition, packaging, storage, and product diversification of bee products. - To train students in quality control, quality assurance, and standardization methods for honey bee products. - To familiarize learners with national and international standards, food safety regulations, and marketing aspects of bee products. - To enhance entrepreneurial and industrial skills related to commercial processing and quality management of apiculture products.			
Course Outcome	After the completion of course, student will be able to- CO-1. Demonstrate knowledge of advanced processing methods for various honey bee products. CO-2. Perform value addition and develop marketable bee-based products with proper packaging and labelling. CO-3. Apply quality assessment and quality management techniques for maintaining product standards. CO-4. Evaluate bee products according to food safety regulations and quality certification requirements. CO-5. Develop entrepreneurial competencies for commercial production, processing, and marketing of honey bee products.			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Advanced Processing of Honey Bee Products: 1.1 Scope and importance of processing of honey bee products 1.2 Scientific processing of honey, beeswax, pollen, propolis, royal jelly, and bee venom 1.3 Modern extraction, purification, and preservation techniques 1.4 Processing equipment and technologies used in honey bee product industries 1.5 Hygienic handling, sanitation, and storage practices for bee products.	8	8	☐ Lecture Method ☐ Demonstration Method ☐ Practical and Laboratory Training ☐ Field Visits / Apiary-Based Learning ☐ Problem-

Unit-II	Value Addition and Product Development 2.1 Concept and importance of value addition in bee products 2.2 Development of value-added honey products: flavored honey, herbal honey, creamed honey, comb honey 2.3 Processing and preparation of beeswax products: candles, cosmetics, polishes, and ointments 2.4 Preparation of pollen, propolis, and royal jelly-based nutraceutical and medicinal products 2.5 Packaging, labeling, branding, and marketing strategies for value-added bee products.	7	7	Based Learning (PBL) ☐ Experiential Learning ☐ Project-Based Learning ☐ Group Discussion and Seminar ☐ ICT-Enabled Teaching
Unit-III	Quality Evaluation and Quality Management 3.1 Quality standards and specifications for honey bee products (FSSAI, AGMARK, Codex standards). 3.2-Physicochemical and microbiological quality parameters of honey and other bee products. 3.3 Detection of adulteration and contamination in honey bee products. 3.4 Quality assurance systems: GMP, HACCP, ISO standards in bee product-industries. 3.5 Traceability, certification, and export quality requirements for bee products.	8	8	
Unit-IV	Entrepreneurship and Industrial Applications 4.1 Entrepreneurship opportunities in honey bee product processing industries 4.2 Small-scale and commercial processing units: establishment and management 4.3 Economics, cost analysis, and business planning for value-added bee products 4.4 Export potential and global market trends of honey bee products 4.5 Sustainable utilization and future prospects of honey bee product industries.	7	7	
1. References: 2. Crane, E. (1990). <i>Bees and Beekeeping: Science, Practice and World Resources</i> . Cornell University Press, USA. 3. Graham, J. M. (2015). <i>The Hive and the Honey Bee</i> . Dadant and Sons, Illinois, USA. 4. Krell, R. (1996). <i>Value-Added Products from Beekeeping</i> . FAO Agricultural Services Bulletin No. 124, Food and Agriculture Organization, Rome. 5. Singh, D. (2020). <i>Commercial Beekeeping: Production, Processing and Value Addition of Beehive Products for Income and Employment Generation</i> . Scientific Publishers (India), Jodhpur. 6. Reybroeck, W. (2014). “Quality Control of Honey and Bee Products.” In Gupta, R. K., Reybroeck, W., van Veen, J. W., & Gupta, A. (Eds.), <i>Beekeeping for Poverty Alleviation and Livelihood Security</i> . Springer Science+Business Media.				

7. Bogdanov, S. (2009). *Honey Composition and Properties*. Bee Product Science Publications, Switzerland.
8. Wu, L. & Li, Q. (2023). *Quality Evaluation of Bee Products*. MDPI Books, Basel, Switzerland.
9. Wu, L. & Li, Q. (2025). *Quality Evaluation of Bee Products – Volume II*. MDPI Books.
10. Alvarez-Suarez, J. M. (Ed.). (2025). *Bee Products – Chemical and Biological Properties* (2nd Edition). Springer Nature.
11. Luo, X., Dong, Y., Gu, C., Zhang, X., & Ma, H. (2021). “Processing Technologies for Bee Products: An Overview of Recent Developments and Perspectives.” *Frontiers in Nutrition*, 8, 727181.
12. Dietemann, V., Neumann, P., Carreck, N. L., & Ellis, J. D. (Eds.). (2021). *COLOSS BEEBOOK, Volume 3: Standard Methods for Apis mellifera Hive Product Research*. International Bee Research Association.
13. Food Safety and Standards Authority of India (FSSAI). (2023). *Food Safety and Standards Regulations for Honey and Bee Products*. Government of India.
14. Codex Alimentarius Commission. (2001). *Codex Standard for Honey*. FAO/WHO, Rome.
15. National Bee Board, India. (2020). *Training Manual on Scientific Beekeeping and Honey Processing*. Ministry of Agriculture & Farmers Welfare, Government of India.

Model Questions

Short Type:

1. Define value addition in honey bee products.
2. What are the major steps involved in honey processing?
3. List any four value-added honey products.
4. What is the importance of beeswax processing?
5. Define GMP in quality management of bee products.
6. What is adulteration of honey? Mention one common adulterant.
7. State the significance of HACCP in honey bee product industries.
8. ☐ What are the major honey bee products used in nutraceutical industries?

Long Type:

1. Describe the modern processing techniques used for honey and other honey bee products.
2. Explain the preparation, packaging, and marketing of value-added honey products.
3. Discuss the physicochemical and microbiological quality evaluation methods of honey bee products.
4. Explain quality assurance systems such as GMP, HACCP, and ISO standards in honey bee product industries.

MCQ

1. Which of the following is a value-added honey product?
a) Bee venom, b) Creamed honey, c) Bee brood, d) Drone larvae
2. Beeswax is mainly used in the preparation of:
a) Soft drinks, b) Candles and cosmetics, c) Fertilizers, d) Animal feed
3. HACCP stands for:
a) Honey Analysis and Control Processing Plan, b) Hazard Analysis and Critical Control Points, c) Health Assessment and Chemical Control Program, d) Hygienic Application and Control of Processing
4. Which honey bee product is widely used as a health supplement?
a) Royal jelly, b) Bee sting, c) Larval skin, d) Bee comb wire
5. The major purpose of filtration in honey processing is to:
a) Increase acidity, b) Remove impurities, c) Add flavor, d) Reduce sweetness.
6. Which organization regulates food safety standards in India?
a) ICAR, b) NABARD, c) FSSAI, d) KVIC
7. Propolis is mainly known for its:
a) Lubricating property, b) Antimicrobial property, c) Coloring property
d) Fermentation property

8. Which quality parameter is commonly used to detect overheating of honey?
a)pH,-b)Moisture,content,c)HMFcontent,d)Ashcontent

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI		
Internal Assessment		
B.Sc. Part III- SEMESTER – VI (NEP)		
Theory Elective-4: Advance Processing, value addition and Quality management of Honey Bee Product		
Code:100235		Max Marks: 20
Sr. No.100231	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05

Practical Elective -4: Advanced Processing, Value Addition and Quality Management of Honey Bee Products

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100236	VI	Practical Elective -4: Advanced Processing, Value Addition and Quality Management of Honey Bee Products	02	60	04	Ext.25+ Int. 25

Course Objectives	1. To provide advanced knowledge on processing techniques of honey and other honey bee products. 2. To develop understanding of value addition and product diversification in bee products. 3. To train students in quality evaluation and quality assurance methods for honey bee products. 4. To impart practical knowledge on packaging, labeling, storage, and marketing of value-added bee products. 5. To familiarize students with national and international quality standards and food safety regulations. 6. To develop entrepreneurial skills for establishing honey bee product processing industries. 7. To understand modern technologies and industrial applications in honey bee product processing. 8. To promote sustainable utilization and commercialization of honey bee products.
Course Outcome	After successful completion of the course, students will be able to: 1. Explain advanced processing methods used for honey and other honey bee products. 2. Prepare and develop value-added products such as flavored honey, herbal honey, beeswax products, and nutraceutical formulations. 3. Evaluate the physicochemical and microbiological quality of honey bee products using standard analytical methods. 4. Detect adulteration and ensure quality assurance through GMP, HACCP, and food safety standards. 5. Apply appropriate packaging, branding, and labeling techniques for commercial marketing of bee products. 6. Analyze economic and entrepreneurial opportunities in honey bee product industries. 7. Demonstrate knowledge of export standards and quality management systems for bee products. 8. Design sustainable and commercially viable processing strategies for honey bee products.
List of Experiment/ Exercise	
1. Extraction, filtration, and hygienic processing of honey using standard equipment. 2. Determination of moisture content, pH, and acidity of honey samples. 3. Estimation of reducing sugars and total sugars in honey. 4. Detection of common adulterants in honey by laboratory methods. 5. Determination of Hydroxymethylfurfural (HMF) content in honey samples. 6. Preparation of value-added products such as flavored honey, herbal honey, and creamed honey. 7. Processing, purification, and preparation of beeswax products including candles and polish. 8. Packaging, labeling, and storage studies of processed honey and bee products. 9. Microbiological quality assessment of honey and other bee products. 10. Industrial visit to a honey processing unit or bee product enterprise for study of quality management and marketing practices.	
References/ E-Contents / E-Books/ Digital Resources / Web Links	

1. [FAO – Value Added Products from Beekeeping](#)
 - Comprehensive digital resource on honey processing, beeswax, pollen, propolis, royal jelly, value addition, packaging, storage, and quality control.
 2. [FAO – Introduction to Value-Added Bee Products](#)
 - Detailed explanation of value-added bee products and their industrial applications in food, cosmetics, and health sectors.
 3. [FAO – Beehive Products Resource](#)
 - Digital fact sheet on honey, wax, pollen, propolis, royal jelly, venom, and their commercial utilization.
 4. [FSSAI – Product Standards and Regulations](#)
 - Official Indian standards related to food safety, honey quality, packaging, labeling, and contaminants.
 5. [FSSAI – Honey Standards FAQ](#)
 - Information on Indian regulatory standards and quality requirements for honey marketed in India.
 6. [FSSAI Notification on Honey Standards and Adulteration Control](#)
 - Resource explaining standards notified for honey and honey products to control adulteration.
 7. [Honey Authentication with Machine Learning Augmented Bright-Field Microscopy](#)
 - Research resource on advanced analytical methods for honey authentication and adulteration detection.
 8. [Unmasking Honey Adulteration through CNN-Based Thermal Image Analysis](#)
 - Digital research article describing modern AI-based quality assurance methods for honey analysis.
 9. [Honey Classification using Hyperspectral Imaging and Machine Learning](#)
 - Advanced resource on honey classification and botanical origin identification using machine learning.
- [A Machine Learning Approach for Honey Adulteration Detection using Mineral Element Profiles](#)
 - Modern digital reference on quality evaluation and adulteration detection of honey using mineral profiling techniques.

Assessment Rubric for Internal Assessment for Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Apiculture) SEMESTER –VI (NEP)	
Code: 100236	Lab: Practical Elective -4: Advanced Processing, Value Addition and Quality Management of Honey Bee Products	Max Marks: 25
Sr. No.	Assessment Criteria	Marks
1	Participation in activities	05
2	Practical Book	05
3	MCQ	10
4	Attendance	05

Assessment Rubric for External Assessment for Practical

E	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Assessment for Lab Work B.Sc.III (Apiculture) SEMESTER – VI (NEP)
---	---

Course Code: 100236	Practical Elective -4: Advanced Processing, Value Addition and Quality Management of Honey Bee Products	Max Marks: 25, Time: 4Hours
Sr. No.	Assessment Criteria	Marks
1	Determination of Quality of Honey (Properties)	07
2	Preparation of value added product of honey	07
3	Processing of wax	07
4		04

Minor: Inspection of Bee Colonies

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100237	VI	Minor: Inspection of Bee Colonies	02	30	02	Ext-30 Int-20

Course Objectives	1. To understand the importance of regular inspection of honeybee colonies. 2. To identify healthy and unhealthy colony conditions during inspection. 3. To understand brood pattern, queen status, food reserves, and bee population. 4. To detect common problems such as diseases, pests, swarming, and queen lessness. 5. Learn how to maintain systematic records of colony observations. 6. To Write suitable remarks and recommend corrective actions based on colony condition. 7. To develop practical skills in handling bee colonies safely and efficiently. 8. To improve colony management through timely decision-making and monitoring.			
Course Outcome	At the end of the course, students will be able to: CO-1. Conduct scientific inspection of bee colonies independently. CO-2. Assess colony strength and productivity accurately. CO-3. Record field observations in standard formats. CO-4. Identify signs of diseases, pests, and nutritional deficiencies. CO-5. Recommend appropriate management practices for colony improvement. CO-6. Maintain apiary records for future reference and analysis. CO-7. Apply corrective measures to enhance honey production and colony health			
Unit System	Content	Workload Allotted (Hrs)	Weightage of marks allotted	Incorporation of Pedagogies
Unit-I	Introduction to Colony Inspection 1.1. Importance and objectives of colony inspection. 1.2. Frequency and timing of inspections. 1.3. Tools and equipment used during inspection. 1.4. Safety precautions while handling bee colonies.	8	8	☐ Lecture Method ☐ Demonstration Method ☐ Practical and Laboratory Training ☐ Field Visits / Apiary-Based Learning ☐ Problem-Based Learning (PBL) ☐ Experiential Learning ☐ Project-Based Learning ☐ Group Discussion and Seminar ☐ ICT-Enabled Teaching
Unit-II	Examination of Bee Colonies 2.1. Identification of queen, workers, and drones. 2.2. Observation of brood pattern and brood stages. 2.3. Assessment of colony strength and food stores. 2.4. Detection of queen lessness and swarming tendency.	7	7	
Unit-III	Detection of Colony Problems 3.1. Identification of common bee diseases. 3.2. Recognition of pests and predators. 3.3. Symptoms of starvation and stress. 3.4. Seasonal problems in bee colonies.	8	8	

Unit-IV	Recording & Corrective Measures 4.1. Methods of maintaining colony records. 4.2. Preparation of inspection sheets/registers. 4.3. Writing remarks and suggesting actions. 4.4. Colony management practices based on inspection findings.	7	7	
References 1. The ABC and XYZ of Bee Culture by A. I. Root and E. R. Root. 2. Beekeeping in India by G. K. Suryanarayana, M. Mohan Raj, and N. B. Deodikar. 3. Honeybee Diseases and Their Management by L. Bailey and B. V. Ball. 4. The Hive and the Honey Bee edited by Joe M. Graham. 5. Practical Manual of Beekeeping by B. K. Gupta. 6. Textbook of Apiculture by A. S. Atwal. 7. Beekeeping: A Practical Guide by Richard E. Bonney. 8. Asian Beekeeping by Wongsiri Siriwat. 9. National Bee Board Training Manuals and Extension Publications. 10. National Bee Board India – Technical guides, training materials, and beekeeping resources. 11. ICAR – Central Bee Research and Training Institute – Educational and research resources on apiculture. 12. FAO Beekeeping Resources – International manuals and publications on beekeeping practices.				
Model Questions				
Short Type: 1. Define colony inspection. 2. Why is regular inspection necessary in beekeeping? 3. Name the tools used during colony inspection. 4. What is brood pattern? 5. How can a queen bee be identified? 6. What are the signs of queenlessness? 7. Mention two common pests of honeybees. 8. What is swarming? 9. Why are colony records maintained? 10. What corrective measures are taken for weak colonies?				
Long Type: 1. Explain the importance and procedure of colony inspection. 2. Describe the method of examining brood pattern and colony strength. 3. Discuss common diseases and pests observed during colony inspection. 4. Explain how colony records are maintained in an apiary. 5. Describe the corrective actions taken for weak and diseased colonies. 6. Discuss safety precautions during bee colony inspection. 7. Explain seasonal management practices based on colony inspection records.				
MCQ: 1. The main purpose of colony inspection is to: a) Disturb bees, b) Assess colony health, c) Reduce honey production, d) Remove brood 2. Which caste lays eggs in a bee colony? a) Worker, b) Drone, c) Queen, d) Soldier 3. A scattered brood pattern generally indicates: a) Healthy queen, b) Poor colony condition, c) Excess honey, d) Strong nectar flow 4. Swarming is mainly associated with: a) Colony reproduction, b) Disease spread, c) Honey extraction, d) Feeding 5. Colony records are useful for: a) Decoration, b) Future management decisions, c) Increasing pests, d) Reducing inspection 6. Presence of eggs in cells indicates: a) Queenright colony, b) Queenless colony, c) Dead colony, d) Diseased colony 7. Which of the following is a common bee pest?				

- a) Wax moth, b) Earthworm, c) Butterfly, d) Grasshopper
8. The best time for colony inspection is:
a) Rainy evening, b) Cold night, c) Sunny day, d) Midnight
9. Weak colonies may be strengthened by:
a) Removing food, b) Providing supplementary feeding, c) Closing hive entrance completely, d) Avoiding inspection
10. Record keeping in beekeeping helps in:
a) Scientific colony management, b) Colony destruction, c) Swarm loss, d) Disease spread

Rubric for Internal Assessment for Theory Paper

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment B.Sc. Part III- SEMESTER – VI (NEP)		
Code:100237	Minor Paper: Inspection of Bee Colonies	Max Marks: 20
Sr. No.	Assessment Criteria	Marks
1	Attendance	05
2	Class Assignments	05
3	Unit Test - MCQ	05
4	Participation in Activity/ Field visit	05

Minor Practical: **Inspection of Bee Colonies**

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100238	VI	Minor Practical: Inspection of Bee Colonies	02	60	04	Ext.25+ Int. 25

Course Objectives	1. To develop skills in systematic inspection of honey bee colonies. 2. To identify different castes, brood stages, and colony conditions. 3. To observe signs of healthy and unhealthy bee colonies. 4. To learn safe handling and use of beekeeping equipment during inspection. 5. To record observations related to colony strength, food stores, and queen activity.
Course Outcome	After completion of this practical, students will be able to: CO-1. Perform proper colony inspection using standard beekeeping practices. CO-2. Identify queen, workers, drones, eggs, larvae, and pupae in a hive. CO-3. Assess colony health, brood pattern, and food reserves. CO-4. Detect early symptoms of diseases, pests, and abnormal colony behaviour. CO-5. Maintain practical records and recommend basic management practices.
List of Experiment/ Exercise	
1. Study of Different Components of a Bee Hive: Identification of brood chamber, super, frames, hive stand, bottom board, and cover. 2. Demonstration and Use of Beekeeping Equipment: Handling smoker, hive tool, bee veil, gloves, and bee brush. 3. Method of Opening and Closing a Bee Hive: Safe procedure for opening and reassembling the hive during inspection. 4. Identification of Honey Bee Castes: Observation and identification of queen, worker, and drone bees. 5. Study of Brood Stages in the Colony: Identification of eggs, larvae, pupae, capped brood, and brood pattern. 6. Assessment of Colony Strength: Estimation of bee population, brood area, and colony activity. 7. Observation of Honey and Pollen Stores: Examination of food reserves available inside the hive. 8. Detection of Queen Presence and Queen lessness :Identification of signs indicating queen-right and queen-less colonies. 9. Inspection for Diseases, Pests, and Enemies: Observation of symptoms of wax moth, mites, ants, and diseased brood. 10. Preparation of Colony Inspection Records: Recording observations related to colony condition, brood health, food storage, and management recommendations.	
References 1. The ABC and XYZ of Bee Culture by A. I. Root and E. R. Root. 2. Beekeeping in India by G. K. Suryanarayana, M. Mohan Raj, and N. B. Deodikar. 3. Honeybee Diseases and Their Management by L. Bailey and B. V. Ball. 4. The Hive and the Honey Bee edited by Joe M. Graham. 5. Practical Manual of Beekeeping by B. K. Gupta. 6. Textbook of Apiculture by A. S. Atwal. 7. Beekeeping: A Practical Guide by Richard E. Bonney. 8. Asian Beekeeping by Wongsiri Siriwat. 9. National Bee Board Training Manuals and Extension Publications. 10. National Bee Board India – Technical guides, training materials, and beekeeping resources.	

Assessment Rubric for Internal Assessment for Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Apiculture) SEMESTER –VI (NEP)		
Course Code: 100238	Minor Practical: Inspection of Bee Colonies		Max Marks: 25
Sr. No.	Assessment Criteria	Marks	
1	Participation in activities	05	
2	Practical Book	05	
3	MCQ	10	
4	Attendance	05	

Assessment Rubric for External Assessment for Practical

E	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Assessment for Lab Work B.Sc.III (Apiculture) SEMESTER – VI (NEP)		
Course Code: 100238	Minor Practical: Inspection of Bee Colonies		Max Marks: 25, Time: 4Hours
Sr. No.	Assessment Criteria	Marks	
1	Exercise on Inspection Equipment	07	
2	Exercise on Identification of bee caste	07	
3	Demonstration of colony Record	07	
4	Viva-voce	04	

VSC: Entrepreneurship Development in Apiculture

Level	Course Code	Semester	Course Name	Credit	Teaching Hours	Exam Duration	Max. Marks
5.5	100278	VI	VSC: Entrepreneurship Development in Apiculture	02	60	04	Int-50

Course Objectives	1. To develop entrepreneurial skills in apiculture and honey bee product management. 2. To provide practical knowledge of commercial beekeeping, apiary establishment, and business planning. 3. To train students in processing, value addition, packaging, branding, and marketing of bee products. 4. To create awareness about financial support, government schemes, and employment opportunities in apiculture. 5. To enhance self-employment and rural livelihood opportunities through sustainable beekeeping enterprises.
Course Outcome	After the completion of this course, student will be able to- CO-1. Students will be able to establish and manage small-scale or commercial apiaries. CO-2. Students will prepare business plans and marketing strategies for apiculture enterprises. CO-3. Students will demonstrate skills in processing and value addition of honey bee products. CO-4. Students will apply quality management and packaging techniques for commercial bee products. CO-5. Students will develop entrepreneurial and managerial competencies for self-employment in apiculture.
List of Experiment/ Exercise	
Introduction to Apiculture Entrepreneurship 1. Scope and importance of apiculture 2. Beekeeping as an agro-based enterprise 3. Types of honey bees and apiary setup 4. Equipment and infrastructure requirements Commercial Beekeeping Practices 1. Colony management techniques 2. Seasonal management of bee colonies 3. Bee diseases, pests, and enemies 4. Pollination services and crop benefits Processing and Value Addition 1. Extraction and processing of honey 2. Processing of beeswax, pollen, propolis, and royal jelly 3. Packaging, storage, labeling, and branding 4. Quality standards and certification of bee products Entrepreneurship and Marketing 1. Entrepreneurship development skills 2. Business planning and project preparation 3. Government schemes, subsidies, and financial assistance 4. Marketing strategies and export potential of bee products Practical/Skill Components 1. Identification and handling of beekeeping equipment 2. Apiary establishment and colony inspection 3. Honey extraction and quality testing	

4. Preparation of value-added bee products
5. Packaging, labelling, and branding exercises
6. Preparation of apiculture business plan/project report

References

- ☐ FAO Beekeeping Manual
- ☐ [National Bee Board, India](#)
- ☐ ICAR-Central Bee Research and Training Institute (CBRTI)
- ☐ [Khadi and Village Industries Commission \(KVIC\) – Honey Mission](#)
- ☐ [Scientific Beekeeping Resources](#)

Assessment Rubric for Internal Assessment for Practical

I	SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Assessment for Lab Work B.Sc. III (Environmental Science) SEMESTER –VI (NEP)		
Course Code:100278		Lab: VSC: Entrepreneurship Development in Apiculture	Max Marks: 50
Sr. No.	Assessment Criteria	Marks	
1	Introduction to Apiculture Entrepreneurship	10	
2	Commercial Beekeeping Practices	10	
3	Processing and Value Addition	10	
4	Entrepreneurship and Marketing	10	
5	Report	10	

Internship/ Apprenticeship corresponding to Major: On Job Training

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Credits allotment
5.5	VI	114239	Apiculture-on-job training	4	120 Hrs.	When the student provided the Certificate of attendance "On job training" for 120 Hrs. will be given 4 credits and as for the less attendance, proportionally given the credits.
Course Objectives :	1. Understand the practical aspects of commercial beekeeping and apiary management. 2. Develop skills in handling bee colonies and beekeeping equipment safely. 3. Gain hands-on experience in honey production, harvesting, processing, and storage. 4. Identify common bee diseases, pests, predators, and their management practices. 5. Learn pollination management and the economic importance of honey bees. 6. Develop entrepreneurial and professional skills related to apiculture enterprises					
Course Outcomes :	Upon successful completion of the training, students will be able to: 1. Manage honey bee colonies independently using standard beekeeping practices. 2. Perform routine apiary operations such as colony inspection, feeding, queen management, and seasonal management. 3. Diagnose common bee diseases and pests and recommend suitable control measures. 4. Extract, process, and evaluate the quality of honey and other bee products. 5. Apply pollination management techniques in agricultural crops. 6. Prepare project reports and business plans for beekeeping enterprises. 7. Demonstrate professional competence in commercial apiculture and allied sectors.					