

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI



THREE YEAR UNDERGRADUATE PROGRAMME

B.Sc. APICULTURE NEP

FACULTY: SCIENCE AND TECHNOLOGY

(Courses effective from Academic Year 202-2)

SYLLABUS

REVISED FROM Session 2026-27

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THREE YEAR UNDERGRADUATE PROGRAMME
B.Sc. APICULTURE (NEP)
FACULTY: SCIENCE AND TECHNOLOGY
Sant Gadge Baba Amravati University
FACULTY: Science and Technology
(Three Years- Six Semesters Bachelor's Degree Programme)

Preamble:

Welcome to the Undergraduate Program in Apiculture, an immersive and comprehensive journey into the world of Applied Life Science. The syllabus has given due importance on the main streams of the body of knowledge on 'Apiculture' with due recognition of its wide spectrum. Adequate emphasis has been given on the new and emerging techniques and understanding of the subject under the changing regime and global context, the ancient Vedic Hymans often refer to bees, their floral relationship and honey. The Indian system of medicines belonging to both Ayurveda and Sidha school heavily rely on honey as a carrier which enhances properties of drugs. After India has launched a massive program of rapid industrialization, special efforts develop agro-based industries like beekeeping. Compared to other agro based industries, beekeeping industry received inadequate attention resulting in to stagnation in the number of honey bee colonies established and production of honey. Collection of honey from wild bee colonies by smoking away the bees and squeezing out their combs for honey was traditional since time immemorial. Efforts were made to introduce *Apis mellifera*. European honey bees, in to India since 1880.

In India , first attempt to keep bees in movable frame hive were made in 1882 in Bengal, . In South India it was around 1910 that Rev. Father Newton designed a smaller hive suitable for the Indian *Apis cerana* honey bees in Kanyakumari district and successfully maintained the Indian honey beesi hive.

Doing this programme will enable acquire knowledge and skill required to develop beekeeping and production of different bee product, provide services of cross pollination to farmers to increase agricultural productivity, to develop employment and self employment opportunities and simultaneously environmental conservation through maintaining biodiversity of honey bees and cross pollination for wild plants.

These major courses are supplemented with specialized vocational skill enhancement courses which are designed to equip the gap between academic learning and vocational expertise. Students immensely meticulously get acquaint with honey bee species, their life cycle and morphology , its food and their availability, bee flora, different bee products like; honey wax propolis, bee pollen, royal jelly and bee venom,, their extraction and applications, bee diseases and enemies, seasonal management , migration for honey production, pollination services etc.

In addition to the core and vocational curricula, this program offers elective courses in critical and interesting areas like Honey Bees and Environment, Honey bee colony, Bee Flora, Nesting Behaviour of Honey Bees, Honey- Marvels Natural Product, in IKS, Indian history of honey bee keeping.

The graduates are not just academically proficient; they are also equipped with practical skills, an ethical mindset, and the capability to innovate and adapt in the dynamic field of Apiculture. They emerge as individuals who are ready to contribute in modern honey bee keeping practices like bee breeding, modern equipment for bee and bee product management , value addition in bee product n quality control and export also. Student also acquire knowledge and apply skills to conserve bee biodiversity, acquiring skills to assist the concerned individuals in identifying and solving environmental problems. Capable to suggest the pathways to attain harmony with nature.

This program is an invitation to commence on a voyage of innovation, learning, and development in the appealing and interesting world of Honey bee Science. Preparing students to become Bee Expert keeping the pace between development of bee keeping industry for socio-economic development of rural India.

Core Competencies:

Apicultural competencies are to carry out beekeeping operations right from understanding bee biology and behaviour, Handle beekeeping systems and beekeeping equipment, Beehive management, Manage insects, diseases and nuisances in beehive to harvesting, processing and market of products.

Based on the guidelines provided by the University Grants Commission under the National Education Policy 2020, the Graduate Attributes for the Discipline of Apiculture for the Undergraduate Program at Sant Gadge Baba Amravati University can be defined as follows:

- Understanding History of honey bee and honey harvesting in ancient India.
- Understanding different honey bee species specially used for honey bee keeping.
- Understanding of identification of bee diseases and bee enemies.
- Understanding the bee products, their extraction, quality control, value addition and marketing.
- Understanding of management of bee colonies for their product, pollinations services and their survival and conservation.
- Understanding importance of honey bee in to increase agricultural productivity and environmental conservation.
- Understanding the role of honey bee in socioeconomic development

Supplementary Educational Attainment

- Analytical skills: Apiculturist often use scientific methods to handle and manage honey bees in their colony, analyses honey and other products for their quality parameters. Uses collected colony inspection data for improvement of honey colony performance for their productivity.
- Critical-thinking skills: Apiculturist must draw logical conclusions from observations from bee colony, and surrounding availability of bee flora and environmental conditions.
- Interpersonal skills: Apiculturist typically work on teams with beekeeper, farmer field labour and market personals. Team members must be able to work together effectively to achieve their goals.
- Problem-solving skills: Apiculturist I scientists try to find the best possible solution to problems that affect health, productivity of bee colonies in Apiary due to scarcity of food, diseases, environmental conditions. They must be able to identify and anticipate problems to prevent losses for the bees and bee colonies, loss in production to safeguard apiary and bees' health, and mitigate adverse impact.
- Experimental Proficiency: Apiculturist demonstrating expertise in to handle bees, extracts products and for its quality analysis.
- Speaking skills: Apiculturist must be able to explain methodology of management of bees for their food, brood, production, services to bee keepers, farmers, trainees and clients, community members who do not have expertise in their area. They often give presentations to colleagues, managers, policymakers, and the general public.
- Writing skills: Apiculturist write technical papers, reports and articles that explain their methods, findings, and recommendations.
- Integration of Digital Tools: Apiculturist Acquiring digital skills and amalgamating fundamental concepts with modern technological tools.
- Self-directed Learning: Acquiring knowledge and skills for higher studies, competitive examinations, and employment readiness.
- Ethical and Psychological Development: Strengthening ethical and moral principles, coupled with psychological resilience.

Curriculum Framework

Multidisciplinary and Holistic Education: Offering a comprehensive, in-depth, and focused curriculum that is student-centric and outcome-based.

Innovation and Curiosity: Promoting experiential learning, hands-on training, field studies, and internships to foster innovation and curiosity.

Adaptation to Modern Technology: Keeping abreast with the latest developments in Apiculture and technology.

Career Readiness: Equipping students with knowledge, competencies, and professional skills for the job market.

These attributes are designed to create well-rounded, skilled, and knowledgeable graduates who are ready to contribute effectively in their chosen careers and as responsible citizens.

Graduate Attributes

Graduates Attributes (GAs) are composed of independently measurable outcomes that signify the capabilities and potentials of the graduate to attain accomplishment and perform in adequate manner at appropriate situations.

The Graduate Attributes of B.Sc. Apiculture are given as below:

GA1. Erudition of Acquaintance: Gain in-depth knowledge and understandings of discipline or professional area across boundaries of nations with an aptitude to identify, access, analyze and synthesize existing and new knowledge, and integrate them for the enrichment of knowledge.

GA2. Analytical Thinking: Critically to address multifaceted scientific issues and bee colony management phenomenon; pertain independent decision for synchronizing information to formulate innovative and intellectual advances towards focused research over wider theoretical and practical domains.

GA3. Problem Solving: Address and solve scientific vis-a-vis bee colony management problems via rational and original thinking; keep updates of different solution avenues and select appropriate options considering their health, economical , and environmental factors.

GA4. Application of Modern Tools: Select, learn and apply appropriate techniques, resources, sophisticated instruments, models for explaining different apiculture related issues and consequences and mitigation activities with a thorough understanding of drawbacks.

GA5. Mutual and Multidisciplinary Competence: Develop sound knowledge and perception about group dynamics, recognize role of individuals in a group, take initiatives and leadership in collaborative-multidisciplinary and trans-disciplinary scientific research, demonstrate a capacity for self-management and teamwork, timely decision-making through openness and flexibility, constructive arguments and rational analysis for achieving common goals and objectives; motivate group members to address environmental issues with a scientific outlook and mitigation approach.

GA6. Communication Skill: Communicate scientific/technological knowhow and new learning to the scientific community and the society at large with strong conviction and confidence so that humanity benefit from the knowledge and technological development. This can be achieved through sound technical proficiency of innovations in field , present trend , technology , writing skill, in-depth subject Apiculture specifics knowledge, by maintaining appropriate standards, by the ability to render as well as receive comprehensible instructions.

GA7. Life-long Learning: Distinguish the importance and possess the ability to prepare and engage in the life-long learning process; also have the ability to transfer the acquired skills in other domains of science; which can be achieved through enthusiasm and commitment to improving knowledge and competence in a continuous manner.

GA8. Ethical values and Social Responsibility: Attain strong academic integrity, professional code of conduct, ethics of experimental research and scientific writings, contemplation of the impact of research findings on conventional practices, and a clear sense of responsibility towards societal needs and reaching the targets for attaining inclusive and sustainable development.

GA9. Entrepreneurial and Business Skills: Develop skills in quality control, value addition in product, marketing and export, providing consultancy services, entrepreneurship, in the areas Establishment of Apiary.

GA10. Research Attitude: Encourage a strong foundation in research for students and motivate them towards IPR.

GA11. Futuristic attitude: Ability to recognize and address current bee management problems, diseases, environmental issues, marketing problems, export issues, non-availability of sufficient food to bees, scientific and technological progress, and biophysical evolutions with a futuristic view; practicing intuitiveness and interest towards scientific prediction via application of basic knowledge of science especially with regard to India's SDGs in terms of economic welfare, social equity and proactive long-term environment management.

Minor Courses on Bees and agriculture focuses on approach to understanding and addressing role and importance honey bees in agriculture . Due to spraying insecticides , we are loosing bee colonies, definitely affects cross pollination for the specific crops, this is the complex issues that affect the environment, society, and economy.

The structure of the Vocational Skill Courses and Skill Enhancement Courses in Apiculture program is strategically designed to provide students with a comprehensive skill set that aligns directly with viable vocational pathways. For example, Inspection of honey Bee Colony, Handling of bees, Keeping Equipment and Bee Foraging and Bee Plants; Nectar pollen and floral sources.This knowledge is then extended and applied in the course enabling students to grasp the business aspects. Basic analysis of parameters can provide students excellent vocational opportunity in areas of Apiculture.

The various aspects integrated in this program definitely build up and boost up the ideas of students so that it will become lead into the new era of global marketing and also raise the value addition, Export, Environmental conservation. This alignment of skills with vocational outcomes is key to providing students with a clear and achievable career path of post-graduation.

Program Outcomes

This program attempts to create attitude and a behavioral pattern in student community and society that attaches importance and priority to create sustainable life style and awareness on beekeeping and related issues. This course is expected to inculcate a critical thinking on various dimensions of apiculture through knowledge, skill, critical thinking and problem-solving. It is an applied academic field that integrates physical, chemical technical and biological sciences, to the study of the honey bees their products.

- Disciplinary knowledge Enable students to develop a comprehensive understanding of various facets of honey bees, hive products, their food, management and its role in environment.
- Critical thinking Build capabilities to identify relevant bee related issues, analyze the various underlying causes, evaluate the practices and policies, and develop framework to make informed decisions.
- Moral and ethical awareness/reasoning Develop empathy for honey bees, bee flora , appreciation for the various ecological linkages within the web of life, awareness and responsibility towards their conservation and environmental protection.
- Think critically and develop appropriate strategies (scientific, social, economic, administrative, and legal) for conservation of bees, environmental protection, conservation of biodiversity, environmental equity, and sustainable development.
- Adopt sustainability as a practice in life, society, and industry.

Integrity and Adaptability: Graduate will Catch up with daily activities to interweave life in an integrated manner. An integrated mindset helps things accomplish at an improved level. Working without boundaries and being flexible is one of the most important skills.

Technological Competency: Graduates will be familiar with modern technologies and tools relevant to Apiculture including species, food, their products and management.

Creativity and Teamwork: Graduates will become creative, creativity is not a skill, it's a necessity. Creativity comes from within. Inclination towards anything makes you explore it more and get into it to a level where you attain expertise. Teamwork and collaboration go together hand in hand. Teamwork is an exceptional skill that makes graduate unique. Indulge with team more and more and examine their qualities to make teamwork stronger.

Branding, Marketing, and Networking Skills: Graduate can get platform to enhance the skills which are essential for scaling the business and boosting opportunities. These skills enable entrepreneurs to promote and sell products or services. Branding creates a unique and memorable image of a product, service, or organization, and marketing promotes them to target consumers. Networking builds relationships and allows individuals to connect with potential customers, partners, suppliers, or colleagues.

Innovation and Problem-Solving Skills: Graduates will have the ability to apply creative and critical thinking to innovate and solve problems in the field of Apiculture.

Employability Potential: The students passing B.Sc. Degree in the subject Apiculture have the opportunity of job , services, employment in the field of Teaching, Researches, Projects, NGO's, KVIB, KVIC, Research Institutes , as a Beekeeper and bee keeping consultant.

This program will definitely boost an ability to establish career in the field of Apiculture or bee keeping. Get acquainted facets of Apiculture with rural industrial, social, economic and environmental impacts of any development of country. An ability to establish Apiary, provide Apicultural consultancy, to analyze hive product, its packaging and marketing.

THREE YEAR UNDERGRADUATE PROGRAMME
B.Sc. APICULTURE under FACULTY: SCIENCE AND TECHNOLOGY
Board of Studies in Zoology (Including Apiculture)

Dhote Dr. Jayashri Dipak (Chairman) Shri Shivaji Science College Amravati.	Gadhikar Dr. Yasharee A. G.V.I.S.H. Amravati
Joshi Dr. Pravin Purushottam Amolkachand Mahavavidyalaya, Yeotmal.	Kale Dr. G.B. G.S. Science Arts, Commerce College, Khamgaon, Dist. Buldhana.
Nandurkar Dr. Sau. H.P. Head Deptt. Of Zoology , SGBAU Amravati.	Makode Dr. P.M. Shri. Dr. R.G. Rathod Arts and College Murtizapur Dist. Akola
Patil Dr. Pradip S. R.A. Arts, Shri M.K. Commerce and S.R. Rathi Science College, Washim.	Sapkal Dr. Hemant P. Shri Shivaji Arts, Commerce and Science College, Akola.
Zilpe Dr. Suvarna Keshavrao Smt. Radhabai Sarda Arts, Commerce College and Science College, Anjangaon Surji Dist. Amravati.	Dr. Atul D. Bobade Department of Zoology Shri Shivaji Science College, Nagpur.
Mali Dr. Rajendra P. Indira Gandhi Senior College, CIDCO New Nanded Dist. Nanded.	Dr. Qureshi Sayyed Obaid C/o C.A. Rawekar, Pethe Nagar, Anjansingi Road, Dhamangaon Rly.Dist. Amravati.
Karlekar Dr. Mangla B. Bhamburkar Niwas, Old Biyani Square, Camp Amravati.	Virani Dr. Ramzan S. Karimbad Housing Society, Pandharkawada, Dist. Amravati.

THREE YEAR UNDERGRADUATE PROGRAMME
B.Sc. APICULTURE under FACULTY: SCIENCE AND TECHNOLOGY
Committees Constituted by BoS (Zoology Including Apiculture) for Curriculum Development in
Apiculture for Semester I and II

Dr. Vijay S. Mangle Department of Apiculture Arts, Science and Commerce College, Chikhaldara	Dr. Hemant P. Sapkal Shri Shivaji Arts, Commerce and Science College, Akola.
Dr. Qureshi Sayyed Obaid C/o C.A. Rawekar, Pethe Nagar, Anjansingi Road, Dhamangaon Rly.Dist. Amravati.	Dr. Pravin Purushottam Joshi Amolkachand Mahavidyalaya Yeotmal.

Sant Gadge Baba Amravati University, Amravati
FACULTY: SCIENCE AND TECHNOLOGY
Teaching and Learning Scheme: for the Degree of Bachelor of Apiculture
FIRST YEAR: SEMESTER – I

Mode of Teaching	Vertical 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	Theory1	100200	Introduction to Honey bee and beekeeping.	2	2	6
			Lab/Practical-1	100201	Apiculture Major Lab-I	2	4	
	b.	Minor	Theory -2	--	--	2	2	6
			Lab/ Pract-2	--	---	2	4	
	c.	GOEC	Theory-1	100261	Honey Bees and Environment.	2	2	4
			Theory-2	100262	Colony organization and bees.	2	2	
	d.	VSC	-	-	-		-	4
		SEC	Lab/Practical-3	100271	SEC Lab-III Handling of bees	2	4	
	e.	AEC - English	Theory		Refer University basket	1	1	6
		AEC –MIL	Theory		Refer University basket	1	1	
		IKS-Generic	Theory		Refer University basket	2	2	
		VEC	Theory		Refer University basket	2	2	
	f.	CC	Outdoor		Separate SOP will be released	2	4	4
		TOTAL				22	30	30

Sant Gadge Baba Amravati University, Amravati
FACULTY: SCIENCE AND TECHNOLOGY
Teaching and Learning Scheme: for the Degree of Bachelor of Apiculture
FIRST YEAR: SEMESTER – II

Mode of Teaching	Vertical 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-2	100202	Food and foraging of Bees	2	2	6
			Lab/Practical-	100203	Major Lab-4	2	4	
	b.	Minor	Theory-4			2	2	6
			Lab/Practical-5			2	4	
	c.	Generic/ Open Elective	Theory3	100263	Bee flora and Foraging	2	2	4
			Theory4	100264	Nesting and social behavior of bees.	2	2	
	d.	VSC	Lab/Practical-6	100272	Activities on - Bee Keeping Equipment and Bee Foraging	2	4	8
		SEC	Lab/Practical-7	100273	Bee Plants; Nectar pollen and floral sources.	2	4	
	e.	AEC - English	Theory		Refer University basket	1	1	4
		AEC –MIL	Theory		Refer University basket	1	1	
		VEC	Theory		Refer University basket	2	2	
	f.	CC	Outdoor		Separate SOP will be released	2	4	4
		TOTAL				22	32	32

- a. The strength of the batch of the Practical for UG Classes shall be 16 with an addition of 10% with the permission of Hon'ble Vice Chancellor. However, for Music Discipline the batch size shall be of 7 students. The number of the students required to constitute a batch or calculate the workload shall be in accordance with the relevant Government Resolution in force at the time, applicable to specific time, region, course type, mode of instruction, and other pertinent factors.
- b. 1 Credit shall mean 1 Hour Teaching per Week per Semester (Total 15 Hrs/ Semester), the duration of 1 Teaching Period will be 60 Minutes. For Practical 1 Credit shall mean 2 Hour Teaching per Week per Semester (Total 30 Hrs/ Semester).
- c. For Examination and Evaluation of Theory Courses, 40 % Marks shall be assigned to Internal Examination and 60% Marks shall be assigned to end-semester external university examination.
- d. Co-curricular Courses: Health and wellness, Yoga Education, Sports and Fitness, Cultural Activities, NSS/NCC, Fine/Applied/Visual/Performing Arts During Semester I, II, III, IV, V and VI. These courses may be taught by Physical Education Director or may be assigned to Language Teacher by the Principal of HEI based on the expertise of the concerned.
- e. Value Education Courses to be selected from the Basket of Courses provided by the University. These courses may be assigned to the Language Teacher by the Principal of HEI based on the expertise of the concerned.
- f. Generic / Open Elective Courses (GE/OE): Courses to be selected from the Basket of Courses provided by the University
- g. Abbreviations: Department Specific Core: DSC, Department Specific Elective: DSE, FSC: Faculty Specific Core, FSE: Faculty Specific Elective, Indian Knowledge System: IKS, Inter Faculty Specific Core: IFSC, Inter Faculty Specific Elective: IFSE, Theory : Th, Practical/Practicum: Pr, Environment Studies: ES, Pre-requisite Course mandatory if applicable: Prq, Laboratory: Lab (Practical), Generic/ Open Electives: OE; Vocational Skill and Skill Enhancement Courses: VSEC; Vocational Skill Courses: VSC; Skill Enhancement Courses: SEC; Ability Enhancement Courses: AEC; Value Education Courses: VEC; OJT: On Job Training: Internship/ Apprenticeship; Field projects: FP; Community Engagement and Service: CES; Co-curricular Courses: CC; RM: Research Methodology; Research Project: RP; MIL: Modern Indian Language

- i. The basic principle of the Credit framework is that Credits are a function of the successful completion of a program of study/ vocational education/ training and assessment. No Credit can be earned by the student unless the student is assessed for the achievement of the desired competencies and outcome of a program.
- ii. Exit options are provided with Certificate, Diploma and Basic Bachelor’s degrees to the students at the end of the second, fourth and sixth semesters of a Four Years Multidisciplinary Degree Programme. Students will receive a Bachelor’s degree with Honors/ Research on successfully completing of all eight semesters of the UG Program either at a stretch or with opted exits and re-entries.
- iii. For the smooth success of four-year degree programme with multiple entry and exit systems, the examination mode should be based on the combination of innovative trends in formative (informal and formal tests administered during the learning process) and summative (evaluation of students learning at the end of an instructional unit) examination modes in line with the UGC Report on ‘Evaluation Reforms in Higher Educational Institutions (2019).

Examination, Evaluation and Assessment Scheme
The total marks for each Course shall be based on Continuous Assessment and Semester End Examination.
Each theory course of Major, Minor, GE/OE, AEC, IKS, VEC as mentioned in Teaching Learning Scheme prepared by the Board of Studies shall be evaluated as per the scheme as mentioned in the following table -

Table: 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	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks
a	Major	External & Internal	30	9	20	6	50	20	25	10	25	10	50	20
b	Minor		30	9	20	6	50	20	--	--	--	--	--	--
c	Generic/ Open Elective		30	9	20	6	50	20	--	--	--	--	--	--
d	VSC	Internal	--	--	50	20	50	20	--	--	50	20	50	20
	SEC	Internal	--	--	50	20	50	20	--	--	50	20	50	20
e	AEC (Eng. & One MIL Composite)	External & Internal	30	9	20	6	50	20	--	--	--	--	--	--
	IKS (Generic)	External & Internal	30	9	20	6	50	20	--	--	--	--	--	--
	VEC	External & Internal	30	9	20	6	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/CEP													
	CC													

Continuous Assessment Tests (CAT)

- For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under-
- i. Three CAT each of 8 / 10 Marks (Theory) as applicable 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.
 - ii. Each concurrent assessment (CAT-I, II & III) will be mapped to relevant Course Learning Outcome.
 - iii. Total Performance in CAT (i.e. 40 %) shall be based on the best two out of three in CAT examinations
 - iv. Internal assessment shall be carried out by the respective course teacher by choosing variety of assessment tools/methods such as class test, record book, 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.

Conduction of the Examination:

As per the scheme of teaching, learning, examination and evaluation, theory/practical examinations of Semester-I, II, III, IV, V, VI, VII and VIII shall be conducted by the University (except for Internal Examinations as applicable) at the end of each semester.

The theory/practical examinations of all the Semesters shall be held as per the following Schedule –

Sr. No.	Name of the Examination	End Sem Examination	Supplementary Examination*
1	Semester-I, III, V and VII	Winter	Summer
2	Semester-II, IV, VI and VIII	Summer	Winter

- * The University may evolve mechanism for conducting repeat end semester examination. Such repeat examinations shall have to be conducted within one month of the regular even semester examination and on demand examination.
1. The practical examination of all semesters shall be conducted by the University at the end of each semester. The HEI shall conduct the Practical examination of odd semesters as per the schedule announced by the University. However, the appointment of the External and Internal Examiners shall be done by the Head or Principal of respective HEI to conduct external examination of the odd semester and the same should be communicated to the University before commencement of the practical examination. The University shall conduct the external practical examination of all even semester by appointing external and internal examiners.
 2. The examinations specified above shall be held twice in a year at such places and on such dates as may be prescribed by the University.
 3. An applicant to an examination specified above, shall pursue a regular course of study in courses prescribed for the examination concerned for not less than one semester in a particular semester in a College/Institute/University department.
 4. Provided that the student shall be eligible to appear for examination if -
 - a. He/she complies with the provisions of the Ordinance pertaining to the Examination in general from time to time.
 - b. He/she has prosecuted a regular course of study in a university department/college affiliated to the University.
 - c. He/she has in the opinion of the Principal shown satisfactory progress in his/her studies.
 5. The provisions of Ordinance No. 6 and Ordinance No. 9 shall be *mutatis-mutandis* applicable to every collegiate/non-collegiate student.
 6. The fees for each theory examination and practical examination conducted by the university shall be as prescribed by the University, from time to time.

Vertical	Type of Course	Course Code	Course Name
Major	Major Theory1	100200	Introduction to Honey bee and beekeeping
Major	Lab/Practical-1	100201	Apiculture Major Lab-1
GOEC	GOEC Theory1	100261	Honey Bees and Environment.
GOEC	GOEC Theory2	100262	Colony Organization of bees.
VSC	--	--	--
SEC	Lab/Practical-3	100271	Lab-3 Handling of bees.

B.Sc. (Part-I) Semester I: Major Theory

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I Th.-1	100200	Introduction to Honey bee and beekeeping.	2	30	2 Hrs	Ext-30 Int-20

Course Objectives:	Explain Classification types of species, colony structure, morphology, anatomy, and behavior of honey bees.			
Course Outcomes:	CO-1: Describes concept of Honey Bee keeping. CO-2: Understand position of Honey Bee species among the insects. CO-2: Acquire knowledge about distribution of species of honey bees. CO-3: Get acquaint about communication system among the casts in the colony. CO-4: Apply, practical and theoretical concept to identify species and casts of bees. CO-5: Identify, weather its behavior is social or solitary.			
Unit System	Contents	Work load Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	1.1. History of bee keeping: Definition, Bee keeping and Apiculture.	8	8	1. Use of diagrams and charts. 2. Experiential learning through field visit to observe species of bees and their behavior.
	1.2. Beekeeping in Worldwide & India			
	1.3. Scope of Beekeeping			
	1.4. Traditional bee keeping, Modern beekeeping			
Unit II	2.1. Urban or backyard beekeeping	7	7	
	2.2. Apiculture development in India - institutions involved. KVIC, CBRTI, KVIB, NBB.			
	2.3. Scope of Beekeeping in India.			
	2.4. Present Scenario of Beekeeping in India			
Unit III	3.1. Ancestry of bees.	8	8	
	3.2 Bees and wasps			
	3.3. Systematics & Classification of honey bees			
	3.4 Solitary & social bees,			
Unit IV	4.1. Asian honey bee species, distribution and identifying characters- <i>A. dorsata</i> , <i>A. cerena</i> indica			
	4.2. <i>A. florea</i> & <i>A. trigona</i> .	7	7	
	4.3. Casts in honey bees- Comparative identifying characters.			
	4.4. Functions of each cast.			
References:	1. Anatomy of Honey bee R.E. Snodgrass. 2. Bees and Bee keeping in India, D.P. Abrol, Kaluani Publications. 3. First Lesson in Beekeeping: Dadant C.D. Malilton, Illinois.			

	4. Beekeeping in Integrated Mountain Development - Economics & Scientific perspective Publication. 5.Beekeeping- Teach yourself Books, By-Vernon F. (1984) 6. The hive & the Honey Bee- 1975, 4th edition Dadant Publication, America. 7. Bees their vision, chemical senses & language-1950, Cornel University Press- By Fon firsh, & Karl. 8. Honey bee Biology 1982- By Free Johnson & Central Association of Bee Keepers England. 9. The Social Behavior of the Bees, 1974 : By Missioner C.D. 10. Beekeeping in India, 1962,82, Sardar Singh, ICAR, New Delhi. 11. Beekeeping by E.F. Phillips. Agro bios (India) Publication. 12. Handbook of Beekeeping by Dharamsingh, Devendra Pratap Singh, Agrobios. 13. ABC & XYZ of Bee Culture (40th Edition) 1982, R.A. Morme and K. Flattum, A.I. Root & Co., 623, W. Liberty St. Medina, Dhid, 44336, USA. 14. Apiculture, 1987 (Translated from French in English by R.K.Kauls 1994), P.Jean-Prost, Oxford and IBH Publication, New Delhi. 15. Bees and Mankind 1982, J.B. Free, George Allen & Unwin (Pub.), Limited London, UK. 25. 16. Biogeography and Taxonomy of Honeybees 1985, F. Ruttnar, Springer-Verlag, Berlin, Jermamy. 17. Bee Biology of the Honey Bee, 87, M. Winston, Harvard University Press, Cambridge, England. 18. The Dance Language and Orientation of Bee 1967, K. Von Fristch, Harvard University Press, Cambridge, England. 19. Ecology and Neutral History of Tropical Bees 1989, D.W. Roubik, Cambridge University Press, Cambridge, England. 20. The Hive and the Honey Bee 1992 (Revised Edition), Graham, Dadint & Sons Inc., Hamilton, Illingis 62341, USA.
Model Questions:	Short Type (At least 8). 1. Give the classification of Hymenoptera. 2. Explain ancient honey bee keeping. 3. Describe modern beekeeping. 4. Explain role of honey bee in environment. 5. Describe solitary bees. 6. Give any four social characters of honey bee. 7. Explain silent function of features of KVIB foe beekeeping. 8. Explain types of wasps.
	Long Type (At least 4): 1. Give history of honey bee keeping. 2. Discuss solitary and social bees. 3. Discuss scope of honey bee keeping. 4. Discuss Indian institutions working for honey beekeeping and its research.
	MCQs for Internal Assessment (At least 8) 1. Honey bees are----- bees. a- social, b-solitary, c- individual, d- unsocial. 2. -----is a social character of honey bees. a- Colony, b- Solitary, c- Isolated, d- individual. 3. ----- The father of Beekeeping. a. Moses Quinby, b-Johann Dzieron, c- Longstroth, d- John Abraham. 4. -----example of primitive beekeeping. a.- wall hive, b- Newton Hive, c- Longstroth Hive, d- Top bar Hive. 5. ----- is the National institute where research on honey beekeeping is carried out. a- NBRI, b- CBRI, c- NEERI, d- NCL. 6. -----is called ancestors of Honey bee. a- House fly, b- Wasp, c- Spider, d- butterfly. 7. In KVIC, “C” stands for ----- --. a- commission, b- Council, c- committee, d- corporation. 8. -----is solitary bee. a. Honey bee, b- Bumbal bee, c- leaf cutter bee, d- pOllen wasp.

Rubric for Internal Assessment for Theory Paper				
SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI				
Internal Assessment				
B.Sc. I (Apiculture) SEMESTER – I (NEP)				
Paper: Maj/Theo-1	Course Code: 100200	Introduction to Honey bee and beekeeping.	Max 20	Marks:
S.N.	Assessment Criteria		Marks	
1.	Attendance		5	
2.	Class Assignments		5	
3.	Unit Test		5	
4.	Participation in Activity/ Field visit		2	
5.	Overall Performance		3	

B.Sc. I Semester-I Apiculture Lab/ Practical - I

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	101201	Apiculture Major Lab-1	2	60	4 Hrs	Ext-25 Int-25

Course Objectives:	- Understand morphology of honey bee. - Describe anatomy of honey bee. - Explain life cycle of honey bee.	
Course Outcomes:	CO-1. Recognize castes in honey bees. CO-2. Identifies different species of honey bees. CO-3. List the parts of bee body. CO-4. Identify queen/drone/worker cell on brood comb. CO-5. Compare the behavior of honey bee and wasp. CO-6. Demonstrate life cycle of honey bee.	
Experiments and activities	- Study of mouth parts of honey bees. - Study of antenna. - Study of wax glands. - Study of proboscis. - Honey Bee species identification. (<i>A. dorsata</i> & <i>A. florea</i>) - Honey Bee species identification. (<i>A. cerena</i>, <i>A. trigona</i>, & <i>A. mellifera</i>). - Identification of Castes (Drone, Queen & worker). - To Study different stages in life cycle of Honey bees. - Identification of Queen cells, Drone cells & Brood - To study the morphological and anatomical characteristics of queen and worker bees - Survey of honey bees occurred in surrounding area. - Survey of wasps occurred in surrounding area.	Incorporation of Pedagogies
		Lab Reports: Students prepare detailed lab reports on morphological and anatomical study of honey bees.
		Discussion Sessions: Group discussions.
		Group Projects: Assign group projects based on field survey.
References:	Study Materials in the form of - Reference Books, Text Books, Research Articles, Digital Resources like Weblinks, E- Contents, Educational Software, Databases, etc.	

Rubric for Internal Assessment for Practical.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Practical Assessment B.Sc. I (Apiculture) SEMESTER – I (NEP)		
Course Code- 100201		Introduction to Honey bee and beekeeping.
		Max Marks: 25
S.N.	Assessment Criteria	Marks
1	Attendance	5
2	Field Visit-Survey Report/ Assignment	5
3	Active participation in activities	5
4	Submission of practical record	5
5	Internal examiner viva-voce	5

Rubric for Internal Assessment for Practical

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Practical Assessment M.Sc. I (Environmental Science), SEMESTER – I (NEP)		
Course Code- 100201 Paper- Major Th-1		Lab/Pr Major: 1
		Max Marks: 25 Time: 4.Hrs.
Question No.	Experiment/ Activity	Marks
1	Exercise-1	10
2	Exercise-2	10
3	Viva-voce	05

B.Sc. (Part-I) SEMESTER I GOEC Theory-1

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	100261	Honey Bees and Environment.	2	30	2 Hrs	30

Course Objectives:	• Explain, means of pollination, different insect pollinating agents and how honey bees are most suitable cross pollination. • Identify importance of honey bees in environment and agricultural productivity. • Describes role of bees in ecosystem. • Identify threats to honey bees.			
Course Outcomes:	CO-1: Define types and means of pollination CO-2: Identify pollinating agents. CO-3: Explain importance of honey bee as a best pollinator. CO-4: Asses role of bees in environment as a pollinator and member of biodiversity. CO-5: Identify threats to honey bees. CO-6: Implements effective control measures to conserve bees.			
Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit-I	1.1. Biodiversity: Insect biodiversity.	8	8	1-Demonstration of process of pollination through using flowers. 2-Observation of foraging bees. 3-. Use of diagrams of different types of pollens. 4. Case study of cruel honey extraction from natural colonies.
	1.2. Bee Species diversity			
	1.3 Pollination: Types and Pollinating agent			
	1.4 Pollination and agriculture, wild plants.			
Unit II	2.1. Worldwide distribution of honey bees	7	7	
	2.2. Honey Bees as pollinator			
	2.3. Foraging range, Body structure, population .es			
	2.4. Honey bees in ecosystem, tapping natural resource			
Unit III	3.1 Productivity: pollination Yield and quality	8	8	
	3.2 Pollination support through beekeeping -Role of honeybees in ecosystem. Pollination services			
	3.3. Comparative efficiency			
	3.4. Nature and honey bees with its Constancy			
Unit IV	4.1 Threats- Cruel honey extraction	7	=7	
	4.2. Habitat loss- Causes and conservation			
	4.3. diseases, enemies.			
	4.4. Climate change, Pesticides			
References:	1. Bees and Bee keeping in India, D.P. Abrol, Kaluani Publications. 2. First Lesson in Beekeeping: Dadant C.D. Malilton, Illinois. 3. Beekeeping in Integrated Mountain Development - Economics & Scientific perspective Publication. 4.Beekeeping- Teach yourself Books, By-Vernon F. (1984) 5. Honey bee Biology 1982- By Free Johnson & Central Association of Bee Keepers England. 6. The Social Behavior of the Bees, 1974 : By Missioner C.D. 7. Beekeeping in India, 1962,82, Sardar Singh, ICAR, New Delhi. 8. Beekeeping by E.F. Phillips. Agro bios (India) Publication. 9. Handbook of Beekeeping by Dharamsingh, Devendra Pratap Singh, Agrobios. 10. ABC & XYZ of Bee Culture (40th Edition) 1982, R.A. Morme and K. Flattum, A.I. Root & Co., 623, W. Liberty St. Medina, Dhid, 44336, USA. 11. Bees and Mankind 1982, J.B. Free, George Allen & Unwin (Pub.), Limited London, UK. 25. 12. Biogeography and Taxonomy of Honeybees 1985, F. Ruttnar, Springer-Verlag, Berlin, Jermamy. 13. Bee Biology of the Honey Bee, 87, M. Winston, Harvard University Press, Cambridge, England. 14. The Dance Language and Orientation of Bee 1967, K. Von Frisch, Harvard University Press, Cambridge, England. 15. Ecology and Neutral History of Tropical Bees 1989, D.W. Roubik, Cambridge University Press, Cambridge, England. 16. Honey Bee Ecology – A study of adaptation in social life 1985, T.D. Seeley, Princeton University Press, Princeton, NJOBS 40, USA.			

Model Questions:	Short Type Explain types of pollination. 1. Describe means of pollination. 2. Give role of bees in pollination. 3. Explain any four threats to honey bees.
	4. What is cross pollination? Give its significance.
	Long Type 1. Discuss importance of cross pollination and explain different insect pollinators. 2. Discuss role of honey bees in conservation of environment. 3. Discuss the natural threats to honey bees. 4. Discuss the causes of habitat loss of honey bees.
	MCQs for Internal Assessment (At least 8) 1. During -----, male part one flower is transferred to female part of another flower. a.-transpiration, b- pollination, c- hibernation, d-germination. 2----- is not a pollinating agent. a. house fly, b- butterfly, c- honey bee, d- pollen wasp. 3. Pollination is essential to the production of andin crops. a. leaves & stem, b- fruits & seeds, c- flowers & branches, d- xylem & phloem. 4..... of the world's food production depends on bees. a-1/3, b-1/2, 100 %, d- 1/10. 5----- is natural cause of destruction of honey bees. a- pesticides, b- habitat destruction, c- diseases, d- air pollution. 6----- is one of the bee disease causing agent. a-Varrora mite, b- B.T., c- mosquito, d- corona virus. 7.Pollination by insects is called ----- --. a.-entomophily, b- anemophily, c- hydrophily, d- zoophily. 8.Honey bee visits flower for to collect..... a-dew, b- pollen, c- fruits, d- seeds

B.Sc. (Part-I) SEMESTER I GOEC Theory-2

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	100262	Colony Organization of bees.	2	30	2 Hrs	30

Course Objectives:	• To understand composition of honey bee colony • Explain social behavior of the colony. • Describe the functions of castes in colony.						
Course Outcomes:	CO-1. Describe the meaning honey bee colony. CO-2. Recognize castes in bee colony. CO-3. Describes the functions of each cast in bee colony. CO-4. Differentiate colonies of different honey bee species. CO-5. Explain nesting behavior of bee species.						
Unit	Contents	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies			
Unit-I	1.1 Kinds of Honey Bees. Structure of Bee colony: number of bees and their castes.	8	8	Use of Charts, real photographs and diagrams to show features of bee colony. Experiential learning through field visit for observation of natural colony of different bee species.			
	1.2 Nesting behavior; Open and dark nesting.						
	1.3 Brood and Honey Comb; single and multi-combs. Distribution of brood and food in comb.						
	1.4 Social interaction among castes.						
Unit II	Metamorphosis	7	7				
	2.1 Queen, queen cell, Identifying characters of queen. functions of queen in colony						
	2.2 Formation of queen, queen cell.						
	2.3 Mating of queen, egg laying.						
2.4 Queen less colonies, Life cycle							
Unit-III	3.1 Worker; Identifying characters, Population						
	3.2 Worker cell, role and its importance in colony						
	3.3 Foraging behavior of worker						
	3.4 Laying workers						
Unit-IV	4.1 Drone; identifying characters of drone.						
	4.2 Drone cell, population, its formation.						
	4.3 Sting, Mechanism of sting action, sting gland						
	4.4Social life in honey bee.						
References:	1. Bees and Bee keeping in India, D.P. Abrol, Kaluani Publications. 2. First Lesson in Beekeeping: Dadant C.D. Malilton, Illinois. 3. Beekeeping in Integrated Mountain Development - Economics & Scientific perspective Publication. 4.Beekeeping- Teach yourself Books, By-Vernon F. (1984) 5. Honey bee Biology 1982- By Free Johnson & Central Association of Bee Keepers England. 6. The Social Behavior of the Bees, 1974 : By Missioner C.D. 7. Beekeeping in India, 1962,82, Sardar Singh, ICAR, New Delhi. 8. Beekeeping by E.F. Phillips. Agro bios (India) Publication. 9. Handbook of Beekeeping by Dharamsingh, Devendra Pratap Singh, Agrobios. 10. ABC & XYZ of Bee Culture (40th Edition) 1982, R.A. Morme and K. Flattum, A.I. Root & Co., 623, W. Liberty St. Medina, Dhid, 44336, USA. 11. Bees and Mankind 1982, J.B. Free, George Allen & Unwin (Pub.), Limited London, UK. 25. 12. Biogeography and Taxonomy of Honeybees 1985, F. Ruttnar, Springer-Verlag, Berlin, Jermamy. 13. Bee Biology of the Honey Bee, 87, M. Winston, Harvard University Press, Cambridge, England. 14. The Dance Language and Orientation of Bee 1967, K. Von Fristch, Harvard University Press, Cambridge, England. 15. Ecology and Neutral History of Tropical Bees 1989, D.W. Roubik, Cambridge University Press, Cambridge, England. 16. Honey Bee Ecology – A study of adaptation in social life 1985, T.D. Seeley, Princeton University Press, Princeton, NJOBS 40, USA.						
Model Questions:	Short Type Explain types of pollination. 5. Describe means of pollination.						

	6. Give role of bees in pollination. 7. Explain any four threats to honey bees. 8. What is cross pollination? Give its significance.
	Long Type 5. Discuss importance of cross pollination and explain different insect pollinators. 6. Discuss role of honey bees in conservation of environment. 7. Discuss the natural threats to honey bees. 8. Discuss the causes of habitat loss of honey bees.
	MCQs for Internal Assessment (At least 8) 2. During -----, male part one flower is transferred to female part of another flower. a.-transpiration, b- pollination, c- hibernation, d-germination. 2----- is not a pollinating agent. a. house fly, b- butterfly, c- honey bee, d- pollen wasp. 3. Pollination is essential to the production of andin crops. a. leaves & stem, b- fruits & seeds, c- flowers & branches, d- xylem & phloem. 4..... of the world's food production depends on bees. a-1/3, b-1/2, 100 %, d- 1/10. 5----- is natural cause of destruction of honey bees. a- pesticides, b- habitat destruction, c- diseases, d- air pollution. 6----- is one of the bee disease causing agent. a-Varrora mite, b- B.T., c- mosquito, d- corona virus. 7. Pollination by insects is called ----- --. a.-entomophily, b- anemophily, c- hydrophily, d- zoophily. 8. Honey bee visits flower for to collect..... a-dew, b- pollen, c- fruits, d- seeds

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	100271	SEC Lab 3 Handling of Bee Colony	2	60	4 Hrs	Int-50

Course Objectives	- To check presence of queen, number of drones and workers in bee colony. - To know average condition of colony. - To check whether colony is infected by any disease.	
Course Outcomes	After completion of the course student should CO-1: Adapt requirement for handling of bee colony. CO-2: Identify the bee casts and their status in the colony. CO-2: Identify the bee disease. CO-3: Determine status of brood and food condition in comb. CO-4: Differentiate bees and wasp. CO-5: Handles the bees of different species.	
Activities	Content	Incorporation of Pedagogies
Experiments	- Study of difference in Honey Bees and Wasp. - Survey of occurrence of wasps in study area. - Study of characteristics of solitary bees. - Study of characteristics of social bees. - Survey of honey bee species in the field with their foraging behavior and their seasonal activities. - Study of identifying characteristics of different species of honey bee species of the region. - Study of identifying characteristic of castes in honey bees. - Study of nesting behavior of different honey bee species. - Behavioral and functional study of honey bee species. - Demonstration of traditional bee keeping. - Behavioral study of different wasps. - Prepare report on contribution of different governmental and non-governmental Institutions in bee keeping and its conservation. - Identification of scope of Bee keeping in your area. - Case study of Bee keeper.	Lab Reports: Students prepare detailed lab reports on their findings. Discussion Sessions: Group discussions. Group Projects: Assign group projects on stoichiometric methods. Class Debates: Discuss the findings amongst the students.
References	- Sara’s Apiculture, K.V. Jayashree, C.S. Tharadevi, N. Armugam. Saras Publications. - Bees and Beekeeping in India. Dr. D.P. Abrol, Kalyani Publications. - Honey Bee, Diseases And Their Management, Abrol D P, Ludhiana Kalyani - A Manual On Management Of Indian Hive Bee Colonies, Dr Wakhle D M, Pune Xlnc Grafiks Publicatios. - Hive Management And Beekeeping, Bhagwat V R New Delhi Dominant - Beekeeping For Profit And Pleasure, Withhead S B, Jodhpur Agrobios Cindia Publication - Bee-Keeping Practice, Stuart F S., Jodhpur Axis Book India - Honey Bees Diseases Parasites, Pests, Predators And Their Management, Nagaraja N., Chennai Mjp Publication - Pheromones Of Social Bees, Free John B., London Nothern Bee Book.	

Rubric for Internal/External Assessment for Practical

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI		
Internal Practical Assessment		
M.Sc. I (Apiculture) SEMESTER – I (NEP)		
Course Code- APC 100261		SEC Lab 3 Handling of Bee Colony
Max Marks: 50		
S.N.	Assessment Criteria	Marks
1	Attendance	10
2	Field Visit-Survey Report/ Assignment	10
3	Active participation in activities	10
4	Submission of practical record	10
5	Internal examiner viva-voce	10

Sant Gadge Baba Amravati University
FACULTY: Science and Technology
Teaching and Learning Scheme (Course Titles) for the Three Year UG Degree of Bachelor of Apiculture
(Three Years- Six Semesters Bachelor’s Degree Programme)
B.Sc. Apiculture
FACULTY: SCIENCE AND TECHNOLOGY
SEMESTER –II

Vertical	Type of Course	Course Code	Course Name
Major	Major Theory-3	100202	Food and foraging of Bees
Major	Major Lab/Practical-4	100203	Apiculture Major Lab-4
GOEC	GOEC Theory-3	100263	Bee flora and foraging
GOEC	GOEC Theory-4	100264	Nesting and Social behavior of bees.
VSC	Lab/Practical Lab-6	100272	Activities on - Bee Keeping Equipment and Bee Foraging.
SEC	Lab/Practical Lab-7	100273	Bee Plants; Nectar pollen and floral sources.

Sant Gadge Baba Amravati University
FACULTY: Science and Technology
Teaching and Learning Scheme (Course Titles) for the Three Year UG Degree of Bachelor of Apiculture
(Three Years- Six Semesters Bachelor’s Degree Programme)

B.Sc. (Part-I) Semester II: Major Theory

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	100202	Food and foraging of Bees	2	30	2 Hrs	Ext-30 Int-20

Course Objectives:	• Explain important plants as a source of food to the bees. • Describes the food of honey bee. • Understand the ways of locating and collection of its food.			
Course Outcomes:	CO-1. Identify source of pollen and nectar to bees. CO-2. Demonstrates structure of flower. CO-3. Compare pollen yielding and nectar yielding plants. CO-4. Identify importance of water to bees. CO-5. Prepares and apply feeding solution to bee colony. CO-6. Identify dearth period. CO-7. Identity needs to provide feeding to colony.			
Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	1.1 Bee flora- cultivated crops, vegetables, wild and horticultural plants.	8	8	1. Use of diagrams and charts pollen. 2. Experiential learning through field visit to observe the source of pollen and nectar yielding plants in the area. Practically prepares the feeding for bee colony. Provides feeding to bee colony.
	1.2. Structure of flower; parts of flower, nectarines, pollens- types			
	1.3 Pollen Foraging- Locating pollen, Passive and active collection of pollen. Pollen gathering from body.			
	1.4. Pollen- transport, unloading, Factors affecting pollen collection. Chemical composition of pollen.			
Unit II	2.1. Nectar foraging; adaption for nectar collection. Average Composition of nectar and pollen.	7	7	
	2.2 Steps in Nectar collection; Locating nectar, nectar gathering, Nectar unloading.			
	2.3. Nectar processing, ripening			
	2.4. Water foraging- water foragers, need of water in colony.			
Unit III	3.1 Foraging range- floral fidelity, temperature and foraging	8	8	
	3.2 Foraging speed, wind and foraging			
	3.3 Foraging behavior, factors affecting foraging.			
	3.4 Foraging algorithm, communication for foraging.			
Unit IV	3.1 Storage of and utilization of stored food	7	7	
	3.2 Food of brood, queen and worker bees; bee bread, royal jelly			
	3.3 Honey flow, dearth period, artificial feeding- its preparation and ways of feeding			
	3.4 Floral calendar- Preparation, advantages.			
References:	9. The Social Behavior of the Bees, 1974 : By Missioner C.D. 10. Beekeeping in India, 1962,82, Sardar Singh, ICAR, New Delhi. 11. Beekeeping by E.F. Phillips. Agro bios (India) Publication. 12. Handbook of Beekeeping by Dharamsingh, Devendra Pratap Singh, Agrobios. 13. ABC & XYZ of Bee Culture (40th Edition) 1982, R.A. Morse and K. Flattum, A.I. Root & Co., 623, W. Liberty St. Medina, Dhid, 44336, USA. 14. Apiculture, 1987 (Translated from French in English by R.K.Kauls 1994), P.Jean-Prost, Oxford and IBH Publication, New Delhi. 15. Bees and Mankind 1982, J.B. Free, George Allen & Unwin (Pub.), Limited London, UK. 25. 16. Biogeography and Taxonomy of Honeybees 1985, F. Ruttnar, Springer-Verlag, Berlin, Jermamy. 18. The Dance Language and Orientation of Bee 1967, K. Von Fristch, Harvard University Press, Cambridge, England. 19. Ecology and Neutral History of Tropical Bees 1989, D.W. Roubik, Cambridge University Press,			

	Cambridge, England. 10. 20. The Hive and the Honey Bee 1992 (Revised Edition), Graham, Dadint & Sons Inc., Hamilton, Illingis 62341, USA. 11. 21. Honey Bee Ecology – A study of adaptation in social life 1985, T.D. Seeley, Princeton University Press, Princeton, NJ OBS 40, USA.
Model Questions:	Short Type (At least 8). 1. Give the names of any four bee crops. 2. What is the importance of bees with reference to productivity of agriculture? 3. Explain the need of water in bee colony. 4. Explain dearth period. 5. Give the importance of Floral Calendar. 6. What is floral Calendar? 7. Explain honey flow.
	Long Type (At least 4): 1. With the help of diagram explain structure of flower. 2. Explain the mechanism of conversion of nectar into honey. 3. Discuss the concept of foraging. 4. Discuss the factors affecting foraging.
	MCQs for Internal Assessment (At least 8) 1. The main food of honey bee is----- b- Honey, b- water, c- pollen, d-wax. 2. -----bee collects and carries pollen from flower to colony. b- Queen, b- Worker, c- Drone, d- Wasp. 3. Honey bee carries pollen into-----. b- Mouth, b- proboscis, c- pollen sac, d- wings. 4. Bee pollen mixed with bee saliva and flower nectar is ----- --. b. honey, b- bee bread, royal jelly, d- propolis. 5. Honey bee converts -----into honey. b- Nectar, b- propolis, c- pollen d- wax. 6. Sugar – rich sticky liquid secreted by scale insects is ----- --. A – honey, b-honeydew, c- propolis, d- royal jelly. 7. Passive pollen collection is pollen collected by bee’s ----- --. a- Proboscis, b- pollen sac, c- body, d- wings. 8. Worker bees collect nectar from flower by..... b- Sting, b- proboscis, c- legs, d- antenna.

Rubric for Internal Assessment for Theory Paper				
SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI				
Internal Assessment				
B.Sc. II (Apiculture) SEMESTER – I (NEP)				
Paper: Maj/Theo-3	Course Code: 100202	Food and foraging of Bees	Max 20	Marks:
S.N.	Assessment Criteria		Marks	
2.	Attendance		5	
3.	Class Assignments		5	
4.	Unit Test		5	
5.	Participation in Activity/ Field visit		2	
6.	Overall Performance		3	

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	100203	Major Lab IV (Food and foraging of Bees)	2	60	4 Hrs	Ext-25 Int-25

Course Objectives:	- To demonstrate the equipment/ wares useful to inspect bee colony. - To handle all types of bee equipment. - Describes the source of pollen and nectar to bee colony.	
Course Outcomes:	CO-1. Calculates incoming pollen load. CO-2. Identifies dearth period of the region. CO-3. Prepares feeding required to bee colony. CO-4. Explains components of bee hives. CO-5. Determines content of moisture of nectar and honey samples. CO-6. Demonstrate honey processing plant. CO-7. Extracts honey from honey frames.	
Experiment and activities	- Calculate the incoming pollen load of live bee colony. - Isolate pollen grains from different honey samples. - Study of pollen from honey samples. - Extract nectar from different flowers. - Determine moisture content of collected nectar. - Identification of collected pollen from comb. - Study of components/ parts of flowers. - Prepare feeding for bee colony. - Study and functions of parts of bee hive. - To fix wax foundation sheet to frame. - Extraction of wax from unutilized comb frames. - Study of unit operations of honey processing plant. - Determine the moisture content of different honey samples. - Study of applications of bee equipment; smoker, hive tool, bee veil, swarm net, queen cage, queen excluder etc. Activities- - Prepare floral calendar of the region. - Find out the dearth period the region. Reports- Preparation of detailed report of honey flow and dearth period of the region.	
		- Demonstration of all equipment, wares useful in beekeeping. - Use of charts. - Experiential learning of preparation of floral calendar. - Demonstration of study parts of flowers. - Preparation of report on field study.

Rubric for Internal Assessment for Practical.

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI Internal Practical Assessment B.Sc. I (Apiculture) SEMESTER – II (NEP)		
Course Code- 100203		Food and foraging of Bees)
		Max Marks: 25
S.N.	Assessment Criteria	Marks
1	Attendance	5
2	Field Visit-Survey Report/ Assignment	5
3	Active participation in activities	5
4	Submission of practical record	5
5	Internal examiner viva-voce	5

Rubric for Internal Assessment for Practical

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI External Practical Assessment M.Sc. I (Environmental Science), SEMESTER –II (NEP)		
Course Code- 100203 Paper- Major Th-4		Lab/Pr Major: 2 Food and foraging of Bees)
		Max Marks: 25 Time:4Hrs.
Question No.	Experiment/ Activity	Marks
1	Exercise-1	10
2	Exercise-2	10
3	Viva-voce	05

B.Sc. (Part-I) SEMESTER II Generic/Open Elective Course-III

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	100263	Generic/Open Elective Course Th-III Bee flora and Foraging	2	30	2 Hrs	30

Course Objectives:	• Explain important plants as a source of food to the bees. • Describes the food of honey bee. • Understand the ways of locating and collection of its food.			
Course Outcomes:	CO-1. Identify source of pollen and nectar to bees. CO-2. Demonstrates structure of flower. CO-3. Compare pollen yielding and nectar yielding plants. CO-5. Prepares and apply feeding solution to bee colony. CO-6. Identify dearth period.			
Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit-I	1.1 -Bee flora – meaning, types, (Ornamental, wild, crop & horticultural)			1. Use of printed list of bee flora whether its is source of nectar or pollen or both. 2. Field visit to observe local bee flora. 3. Preparation of floral calendar. 4. Collection of flowers for the study of pollen and nectar.S
	1.2 -Distribution of bee flora; in region, state and India.	8	8	
	1.3- Floral fidelity and food gathering, influence of environment.			
	1.4 Foraging behavior, factors affecting foraging communication for foraging.			
Unit-II	2.1 Steps in Nectar collection; Locating nectar, nectar preferences, nectar gathering, Nectar unloading.	7	7	
	2.2 Approach to nectarines, time spent on flowers			
	2.3. Nectar processing, ripening			
	2.4. Water foraging- water foragers, need of water in colony.			
Unit-III	3.1 Pollen collection and storage: pollen basket, unloading basket	8	8	
	3.2 Environment and pollen collection			
	3.3 Natural sources of pollen and nectar			
	3.4 Nectar sugar concentration in common flowers.			
Unit-IV	4.1 Storage of and utilization of stored food	7	7	
	4.2 Food of brood, queen and worker bees; bee bread, royal jelly			
	4.3 Honey flow, dearth period, artificial feeding- its preparation and ways of feeding			
	4.4 Floral calendar- Preparation, advantages.			
References:	1. Mellifera Beekeeping and pollination, Avtar S. Atval, Kalyani Publication. 2. Sara’s Apiculture, K.V. Jayshree, C.S. Tharadevi, N. Armugam. Saras Publication. 3. Bees and Beekeepingin India. D.P. Abrol, Kalyani Publications. 4. Bee keeping in India, Singh Saradar. ICAR, New Delhi. 5. Bee Farming in India, Rawat B.S. Rawat Apiaries, Raniket Almoda. 6. Fundamentals of Bee keeping, Shah F.A., Shah Beekeepers Kashmir.			
Model Questions:	Short Type (At least 8). 1. Give the names of any four bee crops. 2. What is he importance of bees with reference to productivity of agriculture? 3. Explain the need of water in bee colony. 4. Explain dearth period. 5. Give the importance of Floral Calendar. 6. What is floral Calendar? 7. Explain honey flow. 8. What is bee flora?			

	Long Type (At least 4): 1. With the help of diagram explain structure of flower. 2. Explain the mechanism of conversation of nectar in to honey.
	3. Discuss the concept of foraging. 4. Discuss the factors affecting foraging.
	MCQs for Internal Assessment (At least 8) 1. The main food of honey bee is----- a-Honey, b- water, c- pollen, d-wax. 2. -----bee collects and carries pollen from flower to colony. a-Queen, b- Worker, c- Drone, d- Wasp. 3. Honey bee carries pollen into-----. a-Mouth, b- proboscis, c- pollen sac, d- wings. 4. Bee pollen mixed with bee saliva and flower nectar is ----- --. a-honey, b- bee bread, royal jelly, d- propolis. 5. Honey bee converts -----into honey. a-Nectar, b- propolis, c- pollen d- wax. 6. Sugar – rich sticky liquid secreted by scale insects is ----- --. a. A – honey, b-honeydew, c- propolis, d- royal jelly. 7. Passive pollen collection is pollen collected by bee’s ----- --. a-Proboscis, b- pollen sac, c- body, d- wings. 8. Worker bees collects nectar from flower by..... a-Sting, b- proboscis, c- legs, d- antenna.

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	I	100264	Generic/Open Elective Course-IV Nesting and social behavior of bees.	2	30	2 Hrs	30

Course Objectives:	• Explain nesting behavior of species of honey bee. • Describes communication systems in bee colony. • Studies mutual behavior among cast in honey bee colony.			
Course Outcomes:	CO-1. Identify nest of bee species. CO-2. Demonstrates open, dark, single comb and multi comb building species of honey bees. CO-3. Understand different purposeful dancing behavior of bees. CO-4. Acquainted with communications in honey bees. CO-5. Describes various bee dances in workers for foraging.			
Unit System	Contents	Workload Allotted (Hrs)	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit-I	1.1 Nesting- nesting styles, characteristics of bees nest, requirements for nesting sites.			1. Use of Charts, 2. Visit to field nests of honey bees. 3. Demonstration for behavioral study of bees through hived bee colonies.
	1.2, Open nesting, cavity nesting, Ground nesting, hollow tree nest, twig nesting	8	8	
	1.3- single comb, multiple combs, nesting material, structure of nest,			
	1.4- Maintenance of nest temperature			
Unit-II	2.1. Social behavior: individual behaviors, include nest building, foraging, storing of pollen and honey.	7	7	
	2.2 Behavior: sequences of activities in life of bees. Division of labor			
	2.3. Chemical communication-pheromones worker produced odors queen produced odors			
	2.4. Ripening food, nursing the brood, temperature regulation, hygiene and defense			
Unit-III	3.1 Dancing behavior: Purpose	8	8	
	3.2 Types: Round and waggle, its purpose			
	3.3 Tremble and alarm, its purpose			
	3.4 Cleaning and joy Dance, its purpose			
Unit-IV	3.1 utilization of pheromones in Agriculture.	7	7	
	3.2 working habits of field bees, colony defense activities.			
	3.3 Functional behavior- nest cleaning activity, fanning, rocking behavior			
	3.4 Recent advances in bee behavior.			
References:				
Model Questions:	Short Type (At least 8). 1. What is cavity nesting? 2. What is the purpose of dance by bees? 3. Explain nesting behavior of A. trigona. 4. Describe fanning behavior of bees. 5. Explain rocking behavior. 6. What are the pheromones? 7. Explain drone pheromones. 8. Explain applications of pheromones in agriculture.			
	Long Type (At least 4): 1. Discuss queen pheromone. 2. With the help of diagram discuss waggle dance. 3. Discuss nursing activity by worker bees. 4. Discuss massage and alarm dance.			
	MCQs for Internal Assessment (At least 8) 1. The aggregates of responses or reactions or movements made by honey bees in any situation is			

	called -----. a- communication, b- behavior, c- habit, d- purpose. 2. Honey bees are----- bees. a- solitary, b- social, c- individual, d- single. 3.----- built multi comb nest. a- A. cerena, b- A. florea, c- A. dorsata, d- mud wasp 4. Honey bees uses -----to share information. a- Dance, b- food, c- water, d- honey. 5. Round dance is movement of worker bees indicating the nearby-----. a- Food, b- enemy, c- water, d- wasp, 6.----- dance is observed when virgin queen has just emerged from a cell in queen less colony. a- Waggle, b- round, c- joy, d- massage. 7. For maintaining internal nest temperature, the bees shows -----behavior outside of bee hive. a- Rocking, b- fanning, c- cleaning, d-dancing. 8. The nesting material of A trigona is -----. a- Wax, b- resin, c-papers, d- mud.
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Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	100272	VSC Lab- VI Activities on - Bee Keeping Equipment and Bee Foraging .	2	60	4 Hrs	Int-50

Course Objectives:	- Describe foo for honey bees. - Explain ways of collection of food for honey bees. - Describe the availability, collection transportation of nectar and pollen by bees. - Demonstrate applications of bee tools and equipment.	
Course Outcomes:	CO-1. identify floral source of honey. CO-2. Determines availability of food in nature. CO-3. Prepares and feeding solution for honey bee colony. CO-4. Applies feeding to bee colony. CO-5. Identify honey flow period. CO-6. Find out the dearth period of the region.	
Experiment and activities	- Study of morphological characters of bee pollen. - Collection of nectar from different flower to asses quantity of nectar in each flower. - Study of morphological adaptations in flower for attracting honey bee. - Estimate quantity of sugar in nectar by Anthrone method. - Extraction of nectar from honey. - Identification of floral source of honey by pollen count. - Preparation of pollen slides. - Collection of honey dew. - Identification of source of honey dew. Field activities- - Survey of source of pollen and nectar rich flowers in field. - Prepare report on propagation of honey bee flora. - Identify dearth period in region. - Monitoring forager bee activity during dearth period. - Preparation of feeding solution. - Study of different types of methods of providing feeding solution to bees.	- Demonstration of all equipment, wares useful in beekeeping. - Use of charts. - Experiential learning of preparation of floral calendar. - Demonstration of study parts of flowers. - Preparation of report on field study.
References:	- Sara’s Apiculture, K.V. Jayashree, C.S. Tharadevi, N. Armugam. Saras Publications. - Bees and Beekeeping in India. Dr. D.P. Abrol, Kalyani Publications. - Ornamental Gardening, Paliwal H K, Mumbai National Publication. - Trees Of Vidarbha, Dhore M M, Amravati Paygun Publication. - Mellifera Beekeeping and Pollination, Atwal A S, Ludhiana Kalyani. - The ABC & XYZ Of Bee Culture, Root Amos Ives, New York A I Root Company. - Alphabetical Guide For Beekeepers, Stevens Ken, London Northern Bee Book. - The Flora of The Presidency of Bombay Vol II, Cooks Theodore, Dehra Dun Shiva Offset Press.	

Rubric for Internal Assessment for Theory Paper			
SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI			
Internal Assessment			
B.Sc. II (Apiculture) SEMESTER – II (NEP)			
Paper: VSC-Theo	Course Code: 100272	Activities on - Bee Keeping Equipment and Bee Foraging .	Max Marks: 50
S.N.	Assessment Criteria		Marks
1	Attendance		10
2	Class Assignments		10
3	Unit Test		10
4	Participation in Activity/ Field visit		10
5	Overall Performance		10

B.Sc. (Part-I)Semester II: SEC Lab-VII

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Marks
4.5	II	100273	SEC Lab VII- Bee Plants; Nectar pollen and floral sources.	2	60	4 Hrs	Int-50

Course Objectives:	- To promote awareness nectar and pollen as a resource, trapped in to plants. - To identify plants beneficial for honey bees. - To Propagate nectar and pollen yielding plant as ornamental avenue wild tree. - To identify rich source of nectar and pollen.	
Course Outcomes:	CO-1. Demonstrate parts of flower. CO-2. Identify strong source for nectar and pollen. CO-3. Acquire knowledge of local bee useful plants. CO-4. Find honey flow period of the region. CO-5. Determines dearth period of the region. CO-6. Prepares map for migration of bee colonies.	
Experiment and activities	- Study of structure of flower. - Morphological study of pollen grains. - Nectar: Study of Nectarines; - Collection of nectar from different flowers. - Determination of sugar/ moisture content in nectar. - Preparation of floral calendar. - Identification of pollen from bee bread/ bee collected pollen. - Study of source of extra floral nectar. - Determination of dearth period. Field Activities: - Study of Bee plants; Crop, Horticultural, Ornamental wild Plants (herbs, shrubs, trees, grasses, climbers). - Survey of Pollen yielding plant. - Survey of Nectar yielding plant	
		- Visit to local fields, forest to study local bee flora. - Use of charts. - Experiential learning of preparation of floral calendar. - Demonstration of study parts of flowers. - Preparation of report on field study.
References:	- Sara’s Apiculture, K.V. Jayashree, C.S. Tharadevi, N. Armugam. Saras Publications. - Bees and Beekeeping in India. Dr. D.P. Abrol, Kalyani Publications.	

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Internal Assessment			
B.Sc. II (Apiculture) SEMESTER – II (NEP)			
Paper: SEC	Course Code: 100273	Bee Plants; Nectar pollen and floral sources.	Max Marks: 50
S.N.	Assessment Criteria		Marks
1	Attendance		10
2	Class Assignments		10
3	Unit Test		10
4	Participation in Activity/ Field visit		10
5	Overall Performance		10