Sant Gadge Baba Amravati University, Amravati.

Faculty- Science and Technology
Programme- B.Sc. (Apiculture)
Subject :- Apiculture

POs:

At the time of graduation, Students will be able to

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PSOs
After successful completion of the Programme, students would be able to

1. Acquire knowledge about different species and casts of the honey bees.
2. Aware about economic importance of honey bees.
3. Identify role of honey bees in nature and in agricultural productivity.
4. use Apiculture for employment, self employment and conservation of nature.
5. Apply knowledge and skill to establish its own apiary or provides services to apiary.
6. Learn various product of honey bees and value addition in these products, create scope for entrepreneurship.
7. assess the pest, and enemies/ predator of honey bees.
8. understand the basics about beekeeping tools, equipment, and managing beehives.
9. Manage beehives for honey production and pollination.
10. Do marketing of various bee products.

Employability Potential of the Programme

Choice of Apiculture, one of the subjects at degree level, has the tremendous potential to entry in one of the uncommon field of Honey Bee keeping. Graduate degree in Apiculture subject offers, development of knowledge and skill ; expertise in - handling of bees and their colonies, identification of the pest that they are suffering with remedial

measures, requirement and supply of food, sources of food, suitable climate, basic requirement for beekeeping , extraction of different products from bee colonies,

As a Beekeeper, bee breeder, Provides Services for cross pollination, Bee product Extractor, Analysis of bee products, Value addition in bee products, Bee Trainer, Bee Entrepreneur- selling Bee Colonies, Establishment of Honey House- Extraction, Processing and Packing of Honey, Honey Export.

Opportunities in Government organizations working in the field of beekeeping are-

- Khadi and Village Industries Commission (KVIC).
- Central Bee Research and Training Institute (CBRTI), Pune
- State Khadi and Village Industries Board (KVIB).
- Directorate of Honey Bee Keeping, Mahabaleshwar.

Private Sector, learner can provide services as –

- Beekeeper
- Honey Processer
- Bee Breeder
- Bee Product Extractor
- Bee Product Analysis and Quality Control.
- Value Addition in bee Product.

Scheme of Teaching, Learning & Examination leading to the Degree in Bachelor of Science in the Programme Apiculture
Three years- Six Semester Degree Programme- C.B.C.S.)
(B.Sc. Part I) Semester I

Sr.	Subject	Subject code	Teaching & Learning Scheme							Duration of Exam Hours	Examination & Evaluation Scheme						
			Teaching Periods Per Week				Credits				Theory		Practical		Total Marks	Minimum Passing	
			L	T	P	Total	T/T	Practical	Total		Theory + MCQ External	Skill Enhancement Module	Internal	External		Marks	Grade
1	Apiculture Theory	DSC-I	6	-	-	6	4.5	-	4.5	03	80	20	-	-	100	40	P
2	Apiculture Practical	PR-I	-	-	6	6	-	2.25	2.25	03	-	-	25	25	50	25	P
3	Total		6	-	6	6	4.5	2.25	6.30	06	80	20	25	25	150	65	P

- **L: Lecture, T: Tutorial, P: Practical**
- # Student may complete their Internship/ Field Work/ Work experience from Second to Fifth semester of Bachelor of Science in the Programme, according to their convenience; @ denotes Non-Examination credits.
- **Note:** Internship/ Apprenticeship/ Field Work Experience (during vacations of semester II to V This will carry 5 credits for learning of 150 hours. Its credits and grades will be reflected in final semester VI credit grade report.

Scheme of Teaching, Learning & Examination leading to the Degree in Bachelor of Science in the Programme Apiculture
(Three years- Six Semester Degree Programme- C.B.C.S.)
(B.Sc. Part I) Semester II

Sr.	Subject	Subject code	Teaching & Learning Scheme							Duration of Exam Hours	Examination & Evaluation Scheme						
			Teaching Periods Per Week				Credits				Theory		Practical		Total Marks	Minimum Passing	
			L	T	P	Total	T/T	Practical	Total		Theory + MCQ External	Skill Enhancement Module	Internal	External		Marks	Grade
1	Apiculture- Theory	DSC-II	6	-	-	6	4.5	-	4.5	03	80	20	-	-	100	40	P
2	Apiculture Practical	PR-2	-	-	6	6	-	2.25	2.25	03	-	-	25	25	50	25	P
3	Total		6	-	6	6	4.5	2.25	6.30	06	80	20	25	25	150	65	P

L: Lecture, T: Tutorial, P: Practical

Student may complete their Internship/ Field Work/ Work experience from Second to Fifth semester of Bachelor of Science in the Programme, according to their convenience; @ denotes Non-Examination credits.

Note: Internship/ Apprenticeship/ Field Work Experience (during vacations of semester II to V This will carry 5 credits for learning of 150 hours. Its credits and grades will be reflected in final semester VI credit grade report.

Syllabus Prescribed for First Year UG Programme
Programme- B.Sc.
Semester - 1

Code of the course/Subject	Title of the course/ subject	Total Number of Periods
APC (1S) Th/Apiculture	Systematic and Morphology of Honey Bees./Apiculture	72

COs

Upon successful completion of this Course, the learners will be able to-

1. Understand position of Honey Bee species among the insects.
2. Identify, weather its behavior is social or solitary.
3. Acquire knowledge about distribution of species of honey bees.
4. Apply, practical and theoretical concept to identify species and casts of bees.
5. Get acquaint about communication system among the casts in the colony.

Unit	Content	Period
I	Insects & Classification- Classification of hymenoptera, position of bee in hymenoptera solitary & social bees, History of honey bee, Systematics (Classification) of honey bee, Honey bee species, Distribution, honey bees, Asian species.	14
II	Honey bee Species- Identifying characters: *A.dorsata, A. cerana, A florae, A. trigona, A .mellifera*. Comparative morphology of Apis species, & individual castes in Apis species, life cycle.	14
III	Parts of Body - Head & Abdomen, wax glands, sting apparatus, scent gland, mechanism if sting	14
IV	Comparative anatomy, digestive system, circulatory system, respiratory system, nervous system, excretory system, reproductive system .	14
V	Nesting behavior, Colony and organization of honey bees the castes- queen, drone and workers, Bee foraging.	14
VI	Behavior and communications in bees- Sense organs , Social behavior, division of labour, bee dance, chemical communication- pheromones.	14
SEM	Study of bee species and castes. Comparative measurement of body size of various bee species. Demonstrates parts of body of bees. Study of nesting behavior of bee species. Observe behavior and communication in bees.	
COs	1. Identify different species of honey bees in local area. 2. Demonstrate casts in bee colonies. 3. Observe present source of pollen / nectar to bee colony, 4. Evaluates the strength of colony, brood, food condition.	
Activities	• Observe the types of foraging bees with the season and flowering plants.	

	• Search nests of bee colonies in local area, and observe –type of species, strength, pollen load, brood food condition.

MOOCs Swayam Cources-

Vocational : Bee keeping ::https://www.classcentral.com/course/swayam-vocational-bee-keeping-17839/course/swayam-vocational-bee-keeping-17839

Beekeeping parts, tools, & equipment : https://www.classcentral.com/course/youtube-beekeeping-parts-tools-equipment-59050/course/youtube-beekeeping-parts-tools-equipment-59050

References Books-

- Anatomy of Honey bee R.E. Snoadgrass.
- List of Reference Books for the subject Apiculture :-
- Bees and Bee keeping in India, D.P. Abrol, Kaluani Publications.
- First Lesson in Beekeeping : Dadant C.D. Malilton, Illinois.
- Beekeeping in Integrated Mountain Development - Economics & Scientific perspective Publication.
- Beekeeping- Teach yourself Books, By-Vernon F.(1984)
- The hive & the Honey Bee- 1975, 4th edition Dadant Publication, America.
- Bees their vision, chemical senses & language-1950, Cornel University Press- By Fon firsh, & Karl.
- Honey bee Biology 1982- By Free Johnson & Central Association of Bee Keepers England.
- The Social Behaviour of the Bees, 1974 : By Missioner C.D.
- Beekeeping in India, 1962,82, Sardar singh, ICAR, New Delhi.
- Beekeeping by E.F.Phillips. Agrobios (India) Publication.
- Handbook of Beekeeping by Dharamsingh, Devendra Pratap Singh, Agrobios.
- 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.
- Apiculture, 1987 (Translated from French in English by R.K.Kauls 1994), P.Jean-Prost, Oxford and IBH Publication, New Delhi.
- . Bee Genetica and Breeding 1986, T.E.Reinderer, Academic Press Inc., London.
- Bees and Bee Keeping Science, Prentice & World Resources, 1990 – Eva Crane, Heinemann Newnes, Oxford, UK.
- Bees and Mankind 1982, J.B.Free, George Allen & Unwin (Pub.), Limited London, UK. 25. Biogeography and Taxonomy of Honeybees 1985, F.Ruttnar, Springer-Verlag, Berlin, Jermany.
- Bee Biology of the Honey Bee, 87, M.Winston, Harvard University Press, Cambridge, England. 27. (The) Dance Language and Orientation of Bee 1967, K.Von Fristch, Harvard University Press, Cambridge, England.
- Ecology and Neutral History of Tropical Bees 1989, D.W.Roubik, Cambridge University Press, Cambridge, England.
- The Hive and the Honey Bee 1992 (Revised Edition), J.Graham, Dadint & Sons Inc., Hamilton, Illingis 62341, USA.
- Honey Bee Ecology – A study of adaptation in social life 1985, T.D.Seeley, Princeton University Press, Princeton, NJOBS 40, USA.

- The Illustrated Encyclopedia of Beekeeping 1985, R.J.Morse and T.Hooper, Alphabet and Image Ltd., Shareborne, Dorset, UK.
- Neurobiology and Behaviour of Honey, 1985, R. Menzal & A. Mercer, Springer-Verlag, Berlin, Germany.
- Phenomenon of Bee, 1987, J.B.Free, Chapman and Hall, London.
- The Social Behaviour of the Bees, A Comparative Study 1974, C.D.Mathener, Harvard University Press, Cambridge, England.

Syllabus Prescribed for First Year UG Programme
Programme- B.Sc.
Semester - II

Code of the course/Subject	Title of the course/ subject	Total Number of Periods
APC (2S) Th/Apiculture	Bee flora-food for honey bee	72

COs

Upon successful completion of this Course, the learners will be able to-

1. Understand exactly what type of food is required to honey bees.
2. Identify whether plant's flower is a source of pollen or nectar or both.
3. Demonstrate structure of flower.
4. Acquire knowledge of pollination and cross pollination.
5. Prepare local floral calendar of the area.
6. Find floral sequence, honey flow period and dearth period of an area.
7. Extract pollen from flower and from combs and prepare pollen slide.

Unit	Content	Period
I	Food for bees- Bee foraging, importance of pollen nectar and water for honey bees. Bee flora.	12
II	Morphology of flowering plant pollination & fertilization development of embryo & fruits. Floral structure & floral biology, Elements of classification & identification of important plant. Role of bee in pollination.	12

III	Pollen basket of forage, bees comb cells used for pollen storage, preparation of pollen side, pollen morphology, morphological characteristic of pollen types, Bee bread	12
	Elementary physiology of nectar, nectar secretion, nature, composition and characteristics of nectar, its transportation ,	12
IV	Identification of floral source, types of pollination, pollinating agents, importance of honey bee among other pollinating bees.	12
V	Bee flora- Nectar and pollen yielding Agricultural crops, wild flora, horticultural flora and its propagation, Toxic plant –nectar and pollen	12
VI	Floral calendar, floral sequence, dearth period, honey flow period , Major and important honey yielding plant- Carvi, Manuka etc.	12
SEM	• Demonstration of structure of flower. • Extraction of nectar from different flowers and measurement of its quantity. • Pollen and nectar storage in brood comb of colony. • Identification of source of plant for nectar and pollen. • Preparation of floral calendar. Estimation of dearth period.	
COs	1. Demonstrate structure of flower. 2. Extracts nectar and measures its quantity. 3. Finds pollen and nectar collected by bees in comb. 4. Identifies nectar and pollen source from plant. 5. Prepares pollen calendar of the area. • Identifies dearth period of an area.	
Activities	• Prepare floral calendar of an area. • Prepare pollen slides for different flowers by extracting pollen from combs. Study of structure different flowers.	

Books

- Insect pollination of crops (Second Edition) 1993, J.B.Free, Academic Press, London
- First lesson in Beekeeping- Dadant C.D. Malliton, Illinois.
- Honey a Comprehensive survey Pub.- Heinemann (London) & International Bee Research Association England.
- Value added products for Beekeeping- Food and Agriculture Organisation United National Bulletin No.124. Beekeeping in Integrated Mountain Development-Economic & Scientific perspective Publication. Beekeeping-Teach yourself Books, By-Vernon F. (1984)
- A.B.C. & X Y Z of Bee culture 39 edition A.Y.Root & Co America
- The hive & the Honey Bee-1975, 4th Edition, Dadant Publication,America
- Honey bee Biology 1982-By Free & Johnson & Central Association of Bee Keepers England
- The social Behaviour of the Bees 1974-By Missioner C.D.
- Beekeeping in India 1962, 82 Sardar Singh- ICAR, New Delhi
- Beekeeping By-E.F.Phillips. Agrobios (India) Publication
- Hand Book of Beekeeping-By Dharamsingh, Devendra Pratap Singh- Agrobios.
- Beekeeping in India Sardar Singh

Syllabus Prescribed for First Year UG Programme

Programme- B.Sc.

Code of the course/subject	Title of the Course/ Subject	No. of periods
APC 1S PR/ Apiculture	Practical -1	06

COs

Upon successful completion of this Course, the learners will be able to-

1. Identify species and castes of Honey Bees.
2. Understand nesting behavior of bees.
3. Inspect honey bee colonies.
4. Acquire knowledge of queen cells of castes.
5. Demonstrate life cycle of honey bees.

1	Identification of species of *Apis and Trigona* with caste differentiation.
2	Identification of castes in different species of honey bees.
3	Identification of wasps.
4	Identification of nests of Honey bees.
5	Measure the body size (length of body and wing size)
6	Note the distinguishing characters of workers of the four bee species and draw diagrams proportionate to the body size.
7	Record the number of cells per 10 linear cm of the worker, drone and honey combs of the given bee species at three different positions and calculate average of 3 readings.
8	Study life cycle of honey bee.
9	Inspection of colony.
10	Identification of Queen cells, Drone cells & Brood.

	Visit to observe foraging honey bees in outdoor field.

Distribution of Marks (Duration 4 Hours)

1. Identification of Honey Bee Species. 10
2. Identification of Castes of honey bee. 10
3. Measurement of Body Size of Bees. 10
4. Spotting 10
5. Field Visit Report 05
6. Viva-voce 05

Total Marks -50

Syllabus Prescribed for First Year UG Programme

Programme- B.Sc.

Code of the course/subject	Title of the Course/ Subject	No. of periods
APC 2S PR/ Apiculture	Practical -2	06

COs

Upon successful completion of this Course, the learners will be able to-

1. Identify species and castes of Honey Bees.
2. Understand nesting behavior of bees.
3. Inspect honey bee colonies.
4. Acquire knowledge of queen cells of castes.
5. Demonstrate life cycle of honey bees.

1	Identification and Study of types of inflorescence
2	Study of Types of Pollen grains and their morphology.
3	Extraction and measurement of water content in nectar.
4	Study of toxic plants
5	Study of pollen bag of bees.
6	Study of structure of flowers .
7	Preparation of floral calendar.
8	Preparation of pollen slides.
9	Observation and study of position and structure nectar in flowers
10	Foraging behavior of bees.
11	Field Visit- Florestic Area.

Distribution of Marks (Time 4 Hours)

1.	Study of structure of given flower	10
2.	Preparation of pollen slide.	10
3.	Measurement of moisture content in nectar.	05
4.	Photographic submission of nectariferus flowers.	05
5.	Field Diary	10
6.	Certified Practical Record	05
7.	Viva-Voce	05
	Total	50

GIC-1

Economy and Entrepreneurship

COs

Upon successful completion of this course, students would be able to

1. Understand products of Apiculture industry
2. Prepare proposal for financial assistance from funding agencies

Products of Apiculture Industry and its Uses(Honey, Bee Wax, Propolis) and Pollen. b. Bee Keeping Industry: Present and future, Role of Bees in cross pollination in horticulture and agriculture Prospects of apiculture as self-employment venture. Preparing proposals (Layout and budget) for financial assistance and funding agencies.

GIC-2

Fundamentals of Honey Beekeeping.\(Lectures -15)

COs

Upon successful completion of this course, students would be able to

1. Acquire knowledge about structure of bee colony, functions of each casts in colony.
2. Demonstrate way extraction of bee products.
3. Identify diseases and pests in honey bee colony.
4. Manage the honey bee colony foe its healthy survival and its bee products.

A general history of beekeeping, Structure of the honeybee colony, Physiology of the domestic honey bee, The

players in the colony, Beekeeping equipment and methods of start-up, Honeybee nutrition and production of nectar and pollen, Swarming and control methods, Natural and integrated pest management Hive management for honey production The harvest, hive products, production and processing, diseases and pests of honey bees.