	11. Global seed germplasm resources and their conservation.	2 hours 2 hours 2 hours
Pedagogy:	Practicals	
References/Readings	**8. Agarwal R.L.** 2007. Seed Technology. Oxford & IBH. **9. Agrawal P.K. and Dadlani M.** 1992. Techniques in Seed Science and Technology. 2nd Ed. South Asian Publications. **10. Agrawal P.K.** 1993. Handbook of Seed Testing. Ministry of Agriculture, GOI, New Delhi. **11. Copland L.O. and McDonald M.B.** 1996. Principles of Seed Science and Technology. Kluwer. **12. ISTA** 2006. Seed Testing Manual. ISTA, Switzerland. **13. Martin C. and Barkley D.** 1961. Seed Identification Manual. Oxford & IBH. **14. Tunwar N.S. and Singh S.V.** 1988. Indian Minimum Seed Certification Standards. Central Seed Certification Board, Ministry of Agriculture, New Delhi.	
Learning Outcomes	Ability to carry out seed germination tests. Ability to work in seed testing labs and commercial seed companies.	

Programme: M. Sc. (Botany)
Course Code: BOO-221
Title of the Course: Plant-Animal Interactions
Number of Credits: 4
Effective from AY: 2018-19

Prerequisites for the course:	Should have basic degree in biology or a student of Masters Programme in any of the life science areas	
Objectives:	Plants and Animals form major groups of living organisms in the World. Myriads of interactions between them are the drivers of evolution. Compartmentalization of biological sciences into various disciplines, viz. Botany, Zoology, Microbiology etc., has taken away the opportunities of students to learn these interactions. This course bridges this gap and throws light on the application of this knowledge in the areas of biodiversity, conservation, pollination, crop productivity, biological control, bioprospecting, etc.	
Content:	**1. Diversity and Plant-Animal interactions:** Mutualism, Antagonism, Commensalism, Competition, Multi-trophic level	6 Hours

	interactions; Species interactions and the evolution of biodiversity; Co-evolution and co-speciation of plants and animals; adaptive radiation; evolutionary history of interactions and evidences in the geological past.	
	2. Pollination Biology: Importance of cross pollination. Special differentiation associated with pollinator attraction – advertisement and reward (pollen, nectar, elaiophores, resin glands, osmophores, optical displays and visual clues). Floral adaptation to different pollinators; insect visitors (Hymenoptera, Diptera, Coleoptera, Lepidoptera, Thysanoptera), birds, bats, non-flying animals. Sapromyiophily, brood-site pollination; fig-wasp interaction and pollination. Foraging theory, foraging strategies and time-niche strategies.	8 Hours
	3. Fruits, Seeds and Dispersal agents: Plant adaptations – Fruit chemistry (chemical compartmentalization – pulp and seed, nutritional aspect of pulp, palatability inhibitors and toxins). Seed coat, seed toxins. Phenology; signals, fruit size and fruit production. Dispersers: range of seed dispersers, frugivores as foragers. Animal adaptations – External and internal morphology, digestive physiology, behaviour. Factors limiting reciprocal, plant and animal specializations.	7 Hours
	4. Herbivores and green plants: Nutritional requirements of insects, seasonal and temporal distribution of nutrients in plant parts; Co-evolutionary arms race – plant defence and animal response; plant defence against herbivores – physical, chemical and 'third party' defences; animal responses – behaviour, detoxification, conjugation, target-site insensitivity, excretion. Herbivory vs plant fitness. Effect of herbivores on plant communities – The Janzen-Connell hypothesis. Effect of herbivores on plant communities. Hormonal interaction between plants and animals.	9 Hours 5 Hours
	5. Ant-plant interactions: Ant-plant symbioses – mutualism and non-mutualism (herbivores, harvesting ants, granivores and leaf-cutting). Ants as primary and secondary seed dispersers; pollination by ants; ant-fed plants and ant gardens; canopy ants; effects of harvesters on vegetation. Fungus growers.	3 Hours
	6. Carnivorous plants: Mechanisms of interaction between carnivorous plants and animals, trap mechanisms; nutritional benefits of carnivory.	7 Hours
	7. **Plant communities as animal habitats:** Adaptations,	

	ecological segregation within and between habitats; mechanisms of habitat selection, effects of plants on animal spacing and aggression. Impact of invasive plants on native plant-animal interactions. Plant-animal interactions in agricultural ecosystems. 8. **Climate change** and break down of plant-animal interactions; impact on community, diversity, productivity and livelihood.	3 Hours
Pedagogy:	Lectures/ tutorials/assignments/self-study/field observations	
References/ Readings	**Abrahamson, W.G.** (ed.). 1989. Plant-animal interactions. McGraw-Hill Book Company, NY. **Burslem, D., M.Pinard and S.Hartley.** 2005. Biotic Interactions in the Tropics: Their Role in the Maintenance of Species Diversity. Cambridge University Press. **Crawley, M.J.** 1986. Plant Ecology. Blackwell Scientific Publications. **Endress, P.K.** 1994. Diversity and Evolutionary biology of tropical flowers. Cambridge University Press. **Harborne, J.B.** 1988. Introduction to ecological biochemistry. Academic Press. **Herrera, Carlos M. and Olle Pellmyr** (eds.). 2002. Plant Animal Interactions: An Evolutionary Approach. Blackwell Science. **Holldobler, B. and Wilson, E.O.** 1990. The Ants. Springer-Verlag. **Lloyd, D.G. and Barret, S.C.H.** 1996. Floral Biology: studies on Floral evolution in Animal pollinated plants. Chapman & Hall. **Price, P.W., T.M. Lewinsohn, G.W.Fernandes and W.W. Benson.** 1991. Plant-Animal Interactions: Evolutionary Ecology in Tropical and Temperate Regions. A Wiley-Interscience publication **Proctor, M., Yeo, P. and Lack, A.** 1996. The Natural History of Pollination. Harper Collins Publishers. **Richards, A.J.** 1986. Plant Breeding systems. George Allen & Unwin, London. **Schaefer, M.H. and G.D. Ruxton.** 2011. Plant-Animal Communication. Oxford University Press. **Seckbach, J. and Z. Dubinsky.** 2010. All Flesh Is Grass: Plant-Animal Interrelationships. Springer Science & Business Media. **Smith, R.L.** 1990. Ecology and field biology. Harper Collins	

	Publishers. **Van der Pijl, L.** 1969. Principles of dispersal in Higher plants. Springer-Verlag. **Waser, N.M. and J. Ollerton.** 2006. Plant-Pollinator Interactions: From Specialization to Generalization.University of Chicago Press. **Whitmore, T.C.** 1990. An introduction to tropical rain forests. Clarendon Press, Oxford. **Willmer, Pat.** 2011. Pollination and Floral Ecology. Princeton University Press	
Learning Outcomes	Would have understood intricate evolutionary relationships between plants and animals including their interdependence. Should have learnt the role of herbivory in phytochemical evolution and its importance in plant based drugs. Would have understood the importance of multicultural practices in the control of pests, organic farming and reduction of chemical pesticides. Able to appreciate the ecosystem services through these plant-animal interactions. Understand the effect of climate change on these interactions, conservation and survival of human species.	

Programme: M. Sc. (Botany)
Course Code: BOO-224
Title of the Course: Post Harvest Technology for Fruit Crops.
Number of Credits: 2
Effective from AY: 2018-19

Prerequisites for the course:	Knowledge of basic Botany and fruit crops at UG level.	
Objective:	The paper deals postharvest technology and processing of various fruit crops. Maturity indices, postharvest physiology, various storage and packaging methods, principles and processing of various fruits, value added products and postharvest diseases are discussed.	
Content:	1. Introduction to post-harvest technology, tropical fruits, major fruit crops of Goa, post-harvest and processing status of Kokum (*Garcinia indica*), maturity indices, harvesting practices for specific market requirements, influence of pre-harvest practices. **2.** Enzymatic and textural changes, respiration, transpiration, temperature, physiology and biochemistry of fruit ripening, ethylene evolution and	**5 hours** **5 hours**

GOA UNIVERSITY
DEPARTMENT OF BOTANY
Semester End Assessment (SEA) Exam Time-Table – May, 2022

Date	Semester II Theory (10:00-1:00 pm)	Semester II Practical (10:00-1:00 pm) & (2:00- 5:00 pm)	Semester IV Theory (10:00-1:00 pm)	Semester IV Practical (10:00-1:00 pm) & (2:00- 5:00 pm)
4/05/2022 (Wed)	BOC-225 PKS/RB			BOC-122 VK/SJ Batch I & II
5/05/2022 (Thurs)		BOC-226 PKS/RB Batch I & II + BOC-324 PKS/RB(R1)(2pm)	BOC-121 VK/SJ BOC-121 VK (R2)	
6/05/2022 (Fri)	BOO-224 SK/SJ BOO-322 BFR (R2)			
7/05/2022 (Sat)	BOC-125 MKJ (R8)		BOO-221 MKJ/RB	
8/05/2022	Sunday			
9/05/2022 (Mon)	BOO-451 RB/SK			BOC-422 BFR/SJ Batch I & II
10/05/2022 (Tue)		BOO-452 RB/SJ Batch I & II + (R1)	BOC-421 BFR/SJ	
11/05/2022 (Wed)	BOO-324 BFR/RB		BOO-326 SK/RB	
12/05/2022 (Thur)		BOO-325 BFR/SJ Batch I & II	BOO-128 RB/VK	
13/05/2022 (Fri)	BOO-328 VK/RB		BOC-323 PKS (R3)(2 pm) BOO-121 PKS (R2)	BOO-455 SJ (R1) (2 pm)
14/05/2022 (Sat)	BOC-123 SJ (R10) BOC-321 RB (R3)		BOO-454 SJ (R2) (2 pm) BOC-221 SK (R2)	
15/05/2022	Sunday			
16/05/2022 (Mon)	BOO-225 MKJ/RB		BOO-453 SJ /RB	

11/04/2022
Head, Department of Botany

Department of Botany

Paper B00221 (Plant Animal Interaction

(No.) (Title)

Teacher's Name Prof. Janarthanan.

GOA UNIVERSITY

ATTENDANCE SHEET

Class : M.A. / M.COM./M.C.A. / M.M.S. / M.SC./Part I/ Part I

Academic Year 2021-22

Term I / II /Months

Total number of lectures delivered by the teacher during the term / Months

Sr. No.	Name of the Students	23/02/22	26/02/22	02/03/22	05/03/22	12/03/22	16/3/22	19/3/22	23/3/22	26/3/22	30/3/22	9/4/22	13/4/22	20/4/22	23/4/22	27/4/22	Total	Remarks
	Date of Lectures																	
	Time of Lectures	9:30-11:30	9:30-11:30	9:30-11:30	9:30-1:00	9:30-11:30	9:30-11:30	9:30-11:30	9:30-11:30	9:30-11:30	9:30-11:30	9:30-11:30	9:30-11:30	9:30-11:30	9:30-11:30	9:30-11:30		
	No. of lectures delivered	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	31	
20P0480027	Palkar Prajakta Ravindra	A	A	A	A	A	A	A									0	0
20P0480028	Pandit Kiran Kumari	P	P	P	P	A	P	A	P	P	P	P	P	P	P	P	27	87.1
20P0480029	Rivonkar Sanjana Satish	P	P	P	P	A	P	P	P	A	P	A	A	P	P	P	23	74.2
20P0480030	Rodrigues Velsina	A	P	P	P	P	P	P	P	P	P	P	P	P	P	P	29	93.5
20P0480031	Sethuraman Sivadarsani	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	31	100
~~20P0480032~~	~~Shaikh Raeesa Bi~~																	~~0~~
20P0480033	Shet Parkar Sanjana alias Samiksha Sajjan	A	P	P	P	P	P	P	P	P	P	P	P	A	P	P	27	87.1
20P0480034	Simepurushkar Asmita Bharat	P	P	P	P	A	A	A	P	P	P	A	P	A	P	P	21	67.7
20P0480035	Simoes Ansifa Meural	P	P	P	P	P	P	P	P	A	P	A	P	A	P	P	25	80.7
20P0480036	Tulaskar Neha Ramakant	P	A	P	P	A	P	P	P	P	A	A	P	A	A	P	19	61.3
20P0480037	Vas Lenora	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	31	100
20P0480038	Velip Akshita Ankush	P	P	P	P	P	P	P	P	P	P	A	P	A	P	P	29	93.5
X 20P0480039	Yamkar Sangita Dhulo	P	P	P	P	A	P	P	P	P	P	A	A	A	A	A	19	61.3
20P0440001	Bernice Ben	P	P	P	P	P	A	P	P	P	P	P	P	P	P	P	29	93.5
20P0440005	Advinson D'Souza	P	P	P	P	A	P	A	P	P	A	P	P	A	P	P	23	74.2
20P0440006	Gracy Fernandes	P	P	P	P	P	P	A	P	P	P	P	P	A	P	P	27	87.1
20P0440009	Sanjeet Gaonkar	P	P	P	P	P	P	A	P	P	P	P	P	P	P	P	29	93.5
20P0440010	Ram Gawas	P	P	P	P	P	P	P	P	P	P	P	A	A	P	A	25	80.7
20P0440012	Jyoti Jha	P	P	P	P	A	P	A	P	P	P	P	P	P	P	P	27	87.1
20P0440023	Shreya Naik	P	P	P	P	P	P	A	P	A	P	P	P	P	P	P	29	93.5
20P0440025	Vithal Naik	X	X	A	A	A	A	A	A	A	A	A	A	A	A	A	4	Not conducted ISAs
20P0440013	Joanna Patric	P	P	P	P	P	P	A	P	P	P	P	P	P	P	P	29	93.5
20P0440027	Uma Pednekar	P	P	P	P	P	P	A	P	P	P	P	P	P	P	A	27	87.1
20P0440029	Divya Shenvi	P	P	P	P	P	P	P	P	P	P	P	P	P	A	P	29	93.5
20P0440032	Prachi Talavnekar	P	A	P	P	A	P	P	P	P	P	P	A	A	P	P	23	74.2
20P0440034	Viraj Vaigankar	A	P	P	P	A	A	A	A	P	P	P	P	A	P	P	19	61.3
20P0440019	Signature of the Teacher																29	93.5
	Signature of the Head of Dept.																	

NOTE: (a) The students shall put their signatures against their respective names at every lecture / class

Goa University

Taleigao Plateau, Sub Post Goa University, Goa 403206 India

SEA MARKS INPUT FORM FOR POST GRADUATE CHOICE BASED CREDIT COURSE (OA-18A) EXAM TO BE HELD IN MAY 2022

College/Department : Department of Zoology

Paper Code: BOO-221

Paper Name: Plant-Animal Interaction

Credits Allotted: 4

Max Marks: 60 4TH SEM - 2ND YEAR May 2022

Seat Number	SEA(60)
20P0440001	41
20P0440005	26
20P0440006	40.5
20P0440009	32
20P0440010	37.5
20P0440012	20.5
20P0440013	42.5
20P0440019	43
20P0440023	46
20P0440027	41
20P0440029	35
20P0440032	29.5
20P0440034	25.5 25.5

Certified that all the sub components have been taken into account while finalising the above marks.

NAME OF EXAMINER: M.K. Janarthanam

EXAMINERS'S SIGNATURE: 18/5/2022

HOD'S SIGNATURE:

Date: 18/06/2022

N.B.NOTE - Department may kindly confirm that the above details are correct with reference to paper title, paper code and number of credits.

<< Absentees should be marked as 'A'(without quotes) >>

<< Crarry forward of marks shcuild be indicated as 'CF' (without quotes) in marks column.>> for ISA