Name of the Programme: M. Sc (Botany)
Course Code: BOT-622
Title of the Course: Plant-Animal Interactions.
Number of Credits: 4
Effective from AY: 2022-23

Prerequisites for the course:	Basic degree in biology.	
Objective(s):	To bridge the gap between various branches of Biological Sciences. To enable its application in Biodiversity, Conservation, Pollination, Crop productivity, Biological control, and Bioprospecting.	
Content:	1. **Diversity and Plant-Animal interactions:** Mutualism, Antagonism, Commensalism, Competition, Multi-trophic level interactions; Species interactions and the evolution of biodiversity; Co-evolution and co-speciation of plants and animals; adaptive radiation; the evolutionary history of interactions and evidence in the geological past; the principle of allocation. 2. **Pollination Biology:** Importance of cross-pollination. Evolutionary origin and early diversification of animal 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, and non-flying animals. Sapromyiophily, brood-site pollination; fig-wasp interaction and pollination. Pollination Biology and gene flow: Foraging theory, foraging strategies, and time-niche strategies. 3. **Fruits, Seeds and Dispersal agents:** Plant adaptations – Fruit chemistry (chemical compartmentalization – pulp and seed, nutritional aspect of pulp, palatability inhibitors and toxins). The seed coat, seed toxins. Phenology; signals, fruit size, and fruit production. Dispersers: range of seed dispersers, seed shadow, frugivores as foragers: seed predators. Animal adaptations – External and internal morphology, digestive physiology, behaviour. Factors limiting recal plant and animal specializations. 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 v/s plant fitness. Herbivore efficiency and ecosystem dynamics, Effect of herbivores on plant	**7 Hours** **10 Hours** **8 Hours** **13 Hours**

	communities – The Janzen-Connell hypothesis. Effect of herbivores on plant communities. Hormonal interaction between plants and animals; hormone signalling in trophic interactions; animal pheromones and defense substances. 5. **Ant-plant interactions:** The origin and early evolution. Ant-plant symbioses – mutualism and non-mutualism (herbivores, harvesting ants, granivores, and leaf-cutting). Ants as primary and secondary seed dispersers; pollination by ants; direct and indirect association with plants; ant-fed plants and ant gardens; canopy ants; effects of harvesters on vegetation. Temporal and spatial variation in ant-plant interactions. Fungus growers. 6. **Carnivorous plants:** Mechanisms of interaction between carnivorous plants and animals, trap mechanisms, nutritional benefits of carnivory; cost-benefit analysis. Evolutionary pathways to carnivory. 7. **Plant communities as animal habitats:** Adaptations, ecological segregation within and between habitats; mechanisms of habitat selection, habitat selection theory, characteristics of plant resources and animal population dynamics, effects of plants on animal spacing and aggression. Animal diversity in relation to plant resource characteristics. Impact of invasive plants on native plant-animal interactions. Plant-animal interactions in agricultural ecosystems. Conservation aspects of plant-animal interactions. 8. **Climate change and breakdown of plant-animal interaction:** Impact on community, diversity, productivity, and livelihood.	**7 Hours** **4 Hours** **8 Hours** **3 Hours**
Pedagogy:	Lectures/ Tutorials/Assignments/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. **Del-Claro, K. and Torezan-Silingardi, H.M.** (2021). Plant-animal interactions. Springer International Publishing, Switzerland. **Del-Claro, K. and Torezan-Silingardi, H.M.** (2021). An evolutionary perspective on plant-animal interactions. In *Plant-animal interactions* (pp. 1-15). Springer, Cham. **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. **Keshamma, E., and Lokare, P.** (2022). Plant Animal Interaction. Book Saga Publications, US. **Lloyd, D.G. and Barret, S.C.H. (**1996). Floral Biology: Studies on Floral evolution in Animal pollinated plants. Chapman and 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 and 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 and Business Media. **Simberloff, D.** (2022). Concise, comprehensive reviews of how invasive plants interact with plants, animals, and microbes. Biological invasions, Springer. **Smith, R.L.** (1990). Ecology and field biology. Harper and Row Publishers, New York. **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:	1. Will enable the understanding of intricate evolutionary relationships between plants and animals, including their interdependence. 2. Will enable to understand the role of herbivory in phytochemical evolution and its importance in plant-based drugs. 3. Will enable to understand the importance of multicultural practices in controlling pests, organic farming, and reducing chemical pesticides. 4. Will enable to appreciate the ecosystem services through plant-animal interactions. 5. Will enable to understand the effect of climate change on plant-animal interactions, conservation, and survival of the human species.	

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GOA UNIVERSITY

School of Biological Sciences & Biotechnology (BOTANY DISCIPLINE)

Semester End Assessment (SEA) Exam Time-Table – November, 2023

Date	Semester I Theory (10:00-12:00 pm)	Semester I Practical (10:00 onwards)	Semester III Theory (10:00-12:00 pm)	Semester III Practical (10:00 onwards)
13/11/2023 Monday	BOT-500 (VK)/SJ BOC-121 (VK) R1			BOT-624 (AN)/RB Batch I & Batch II
14/11/2023 Tuesday		BOT-503 (AN)/RB Batch I & Batch II	BOT-600 (SK)/SJ	
15/11/2023 Wednesday	BOT-504 (SK)/VK			BOT-603 (RB) BOO-452 (RB) R1
16/11/2023 Thursday		BOT-501 (VK)/RB Batch I & Batch II	BOT-628 (SJ) BOO-324 (BFR) R1	
17/11/2023 Friday	BOT-502(AN)/VK/RB BOC-321 (RB) +R2			BOT-601 (SK)/SJ Batch I & Batch II
18/11/2023 Saturday			BOT-602 (RB) BOO-128 (RB) R1	
19/11/2023	Sunday			
20/11/2023 Monday		BOT-505 (SK)/SJ Batch I & Batch II	BOT-622 (AN)/VK/RB	
21/11/2023 Tuesday	BOT-506 (PKS/RB) BOC-225 (PKS) R3 BOC-323 (PKS) R1			BOT-629 (SJ)
22/11/2023 Wednesday		BOT-507 (PKS/RB) Batch I & Batch II	BOT-604 (SJ) BOC-421(BFR) R1 BOT-510 (BFR) R1	
23/11/2023 Thursday	BOT-521(BFR) BOO-322 (BFR) R1 BOT-523 (RB)		BOT-627 (VK)	BOT-605 (SJ)
24/11/2023 Friday		BOT-524 (RB) (10 am) BOT-522 (SJ) (2 pm)	BOT-621 (SJ)/VK BOO-453 (SJ) R1	
25/11/2023 Saturday			BOT-623 (AN)/RB/SJ	

Programme Director, Botany

Vice-Dean (Academic), SBSB

Dean, SBSB

GOA UNIVERSITY
ATTENDANCE SHEET

SCHOOL SBSB

COURSES BOT-622 (Plant Animal Interact)

(Code) (Title)

Teacher's Name Dr. Adit Naik

Programme Name : M.Sc Biotechnology

Academic Year 2023-24

Semester III

Total number of lectures delivered by the teacher during the Semester 60L

Sr. No.	Name of the Students	Date of Lectures	16/6/23	23/6/23	13/7/23	14/7/23	20/7/23	21/7/23	3/8/23	4/8/23	11/8/23	17/8/23	18/8/23	24/8/23	25/8/23	31/8/23	1/9/23	7/9/23	Total	Remarks
		Time of Lectures	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30	2.30 - 4.30		
		No. of lectures delivered	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
		Sr. No. / Name of the Students	16/6/23	23/6/23	13-7-23	14-7-23	20-7-23	21/7/23	3-8-23	4/8/23	11/8/23 25A-1	17/8/23	18/8/23	24/8/23	25/08/23	31/8/23	1/9/23	7/9/23	8/9/23	
22P0470015	Samradni Paigankar						Ab		Ab											
22P0470002	Ambika S. Pednekar		Ab					Ab	Ab											
22P0470003	Ankit Anuroop Naik					Ab														
22P0470025	Vedha Damodar Dessai				Ab			Ab	Ab					Ab	Ab	Ab	Ab	Ab		
22P0470006	Joleta D'costa							Ab	Ab											
22P0470005	Hari Arun Marathe		Ab											Ab						
22P0470009	Melisha Cardoso							Ab	Ab											
22P0470022	Tanvi D. Shirodkar							Ab	Ab											
22P0470018	Sushant Majalikar								Ab											
22P0470023	Vaishavi V. Parikar							Ab	Ab											
22P0470007	Kaushiki Kamat							Ab	Ab											
22P0470008	Kiran Vishu Naik							Ab	Ab							Ab				
22P0470004	Carissa Noemia De Sa		Ab	Ab	Ab	Ab	Ab	Ab	Ab				Left							
22P0470013	Rajan D. Amoncar		Ab					Ab	Ab											
	Signature of the Teacher																			
	Signature of the Programme Director / Vice Dean / Dean																			

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

GOA UNIVERITY					
Exam	November 2023 Examination (Master of Science in Biotechnology - MSBT)				
College	School of Biological Sciences & Biotechnology (SBSB)				
Programme	Master of Science in Biotechnology				
	--				
Paper	BOT-622	Plant-Animal Interactions			
Paper Head	SEA	**Max Marks**	40	**Credits**	4

Seat No	SEA Marks
22P0470002	32½
22P0470003	35
22P0470005	31½
22P0470006	26½
22P0470007	26½
22P0470008	29
22P0470009	32½
22P0470013	34½
22P0470015	31
22P0470018	28
22P0470022	26
22P0470023	30½
22P0470025	31

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

Dr. Aditi Naik

NAME OF EXAMINER EXAMINERS'S SIGNATURE Dean/Programme Director/ Principal's Signatu

Date:_____

N.B.NOTE : Department/College 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) >>
<< Carry forward of marks should be indicated as 'CF' (without quotes) >>

GOA UNIVERITY					
Exam	November 2023 Examination (Master of Science in Marine Biotechnology - MSMB)				
College	School of Biological Sciences & Biotechnology (SBSB)				
Programme	Master of Science in Marine Biotechnology				
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Paper	BOT-622	Plant-Animal Interactions			
Paper Head	SEA	**Max Marks**	40	**Credits**	4

Seat No	SEA Marks
22P0500003	30½
22P0500011	31½
22P0500016	32

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

Dr. Aditi Naik

NAME OF EXAMINER

EXAMINERS'S SIGNATURE

Dean/Programme Director/ Principal's Signatu

Date:_____

N.B.NOTE : Department/College 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) >>
<< Carry forward of marks should be indicated as 'CF' (without quotes) >>