rse Pre-requisites, if any	**NA**	
native Assessment Marks: 40	**Summative Assessment Marks: 60**	**Duration of ESA: 03**

rse omes

After completing this course satisfactorily, a student will be able to:

1. Understand the diversity and affinities among Algae, Bryophytes, Pteridophytes and Gymnosperms.
2. Understand the morphology, anatomy, reproduction and life cycle across Algae, Bryophytes, Pteridophytes and Gymnosperms, and their ecological and evolutionary significance.
3. Obtain laboratory skills/explore non-flowering plants for their commercial applications.

No.	**Course Content**	**Hou**
I	**Chapter No. 1** Algae –Introduction and historical development in algology. General characteristics and classification of algae, Diversity- habitat, thallus organization, pigments, reserve food, flagella types, life-cycle and alternation of generation in Algae. Distribution of Algae. **5Hours** **Chapter No. 2** Morphology and reproduction and life-cycles of Nostoc, *Oedogonium*, *Spirogyra*, *Ectocarpus and Batrachospermum*. Diatoms and their importance. Blue-green algae-A general account. Algal blooms and toxins. **5Hours** **Chapter No. 3** Algal cultivation- Cultivation of microalgae-*Spirulina*;Algal cultivation methods in India. Algal products- Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae and uses. **3 Hours**	1
II	**Chapter No. 4.** Bryophytes – General characteristics and classification of Bryophytes, Diversity-habitat, thallus structure, Gametophytes and sporophytes. **5 Hours** **Chapter No. 5** Distribution, morphology, anatomy, reproduction and life-cycles of *Riccia*, *Anthoceros*, and *Funaria.* Ecological and economic importance of Bryophytes. Fossil Bryophytes. **3 Hours** **Chapter No. 6. . Pteridophytes**- General characteristics and classification; Structure of sporophytes and life-cycles. Distribution, morphology, anatomy, reproduction and life-cycles in Psilotum, *Selaginella*, *Equisetum*, *Pteris*. **5Hours**	1
III	**Chapter No. 7** A brief account of heterospory and seed habit. Stelar evolution in Pteridophytes. Affinities and evolutionary significance of Pteridophytes. Ecological and economic importance. **5Hours** **Chapter No. 8. Gymnosperms-** General characteristics. Distribution and classification of	1

	Gymnosperms. Study of the habitat, distribution, habit, anatomy, reproduction and life-cycles in Cycas, Pinus andGnetum. **5 Hours** **Chapter No. 9.** Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses and medicines. **3 Hours**	
it IV	**Chapter No. 10. Origin and evolution of Plants:** Origin and evolution of plants through Geological Time scale. **2 Hours** **Chapter No. 11. Paleobotany-** Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating. **6 Hours** **Chapter No. 12.** Fossil taxa- *Rhynia, Lepidodendron,Lyginopteri* Exploration of fossil fuels. BirbalSahni Institute of Paleosciences. 5 Hours	1

Recommended Leaning Resources

urces

Text Books:

Text Books

1) Chopra,G.L.AtextbookofAlgae.Rastogi&Co.,Meerut,Co.,NewDelhi,Depot. Allahabad.
2) Johri, LataanfTyagi, 2012, A Text Book of, Vedam e Books, NewDelhi.
3) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. NewDelhi.
4) Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.
5) Sharma, O.P., 2017, AlgaeSingh-Pande-Jain2004-05. A Text Book ofBotany. Rastogi Publication, Meerut.

References

1. Sambamurty, A.V.S.S.. A Text Book of Algae. I.K. International Private Ltd., New Delhi.
2. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and Allie plants. Hutchinson & Co., Ltd., London.
3. Anderson R.A. 2005, Algal cultural Techniques, Elsievier, London.
4. Publication, Application in exploration of fossil fuels. Oxford & IBH., New Delhi.
5. Eams, A.J., (1974) Morphology of vascular plants - Lower groups. Tata Mc Grew- Hill Publishing Co Delhi, Freeman & Co., New York.
6. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
7. Goffinet B and Shaw A.J. 2009, Bryophyte Biology, 2nd ed. Cambridge Unversity Press,

Cambridge.Gymnosperms.
8. Srivastava, H N, 2003. Algae Pradeep Publication, Jalandhar, India.
9. Kakkar, R.K. and B.R.Kakkar(1995) The Gymnosperms (Fossils and Living) Central Publishing Hou Allahabad.
10. Kumar H. D., 1999, Introductory Phycology, Affiliated East-West Press, Delhi.
11. Lee, R.E., 2008, Phycology, Cambridge Unversity Press, Cambridge. 4th edition.McGraw Hill Publish Co., New Delhi.
12. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allhabad.
13. Parihar, N.S. (1976) An Introduction to Pteridophytes, Central Book Depot, Allhabad.
14. Parihar, N.S. 1977. The Morphology of Pteridophytes. Central Book Depot.,Allahabad.Press, Cambridge.
15. Rashid, A. 1998. An Introduction to Pteridophyta. II ed., Vikas Publishing House, New D
16. Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes &Pteridophytes. Tata Tata McGraw Hill Publishing, New Delhi.
17. Smith, G.M. 1971. CryptogamicBotny. Vol.I Algae & Fungi. Tata McGraw Hill Publishing. New Dell
18. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.
19. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants, Cambridge UniversityCambridge.

	I	**Course Code: 21BSC2BOT2P** **Course Title:Diversity of Non flowering plants**	**Credits**	**02**
	2		**Hours**	**45**

rse Pre-requisites, if any:	**NA**	
native Assessment Marks: 25	**Summative Assessment Marks: 25**	**Duration of ESA: 03 hrs.**

Practical-1: Study of morphology, classification, reproduction and lifecycle of Nostoc, Oscillatoria.

Practical-2: Study of morphology, classification, reproduction and life-cycle of Oedogonium& Spirogyra, Ectocarpus and Batrachospermum.

Practical-3: Study of morphology, classification, reproduction and life-cycle of Riccia&Anthoceros/ Funaria.

Practical-4: Study of morphology, classification, anatomy, reproduction and life-cycle of Selaginella and Equisetum.

Practical -5: Study of morphology, classification, anatomy, reproduction and life-cycle of Pteris, Azolla/.Psilotum

	Practical -6: Study of morphology, classification, anatomy and reproduction in Cycas. Practical -7: Study of morphology, classification & anatomy, reproduction in Pinus. Practical -8: Study of morphology, classification & anatomy, reproduction in Gnetum. **Practical -9**: Study of important blue green algae causing water blooms in the lakes. **Practical -10**: Preparation of natural media and cultivation of Azolla in artificial ponds. **Practical -11:** Study different algal products and fossils impressions and slides. **Practical-12:** Visit to algal cultivation units/lakes with algal blooms/Fern house/ Nurseries/Geology museum/lab to study plant fossils. (Note: Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)

Evaluation Scheme for Lab Examination

Assessment Criteria		Marks
Classification and description		10
T.S. of given material		05
Identification		05
Viva Voice /Tour report		05
Total		**25**

OPEN-ELECTIVE SYLLABUS:

Year	I	**Course Code:** 21BSC1BOT2	**Credits**	03
Sem.	II	**Course Title:** Bio-fuels	**Hours**	40
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	
Course Outcomes		At the end of the course the student should be able to: 1. To make the students familiar with Bio-fuel plant species cultivation for commercialexploitation. 2. To make the students known about the Bio-fuel used in automobile industries and solvingfuel problems in feature. 3. To generate interest amongst the students to know the importance of Bio-fuel in day todaylife and economic wellbeing. 1.		

Unit No.	Course Content	Hours
Unit I	Introduction, definition, scope and Importance of Bio-fuel with respect to climate change and environmental issues. Public awareness. Biofuels scenario in India and world. History of Biofuels. Advantages and disadvantages of biofuels. Developmental generation of biofuels: first, second, third and fourth generation of biofuels andpresent status.	10
Unit II	Biofuel feed stocks: Agricultural waste, farm waste, forestry waste, organic wastes from the residential, institutional and industrial waste and its importance.(Biomass- plant, animal and microbial based waste). Algal biofuel.	10
Unit III	Biodiesel species: *Pongamia pinnata, Simarouba gluca, Jatropha curcas, Azardirachta india, Madhuca indica* and *Callophyllum innophyllum* . Seed harvesting, processing, oil extraction, and characterization.	10
Unit IV	Introduction to biodiesel, bioethanol, biogas and bio hydrogen. Production technology of biofuels (Biodiesel, ehanol and biogas). Quality analysis of biodiesel, bioethanol and biogas and its comparison with national and international standards. Biofuel sustainability; Biofuel Policy in Karnataka and India. Biofuel production statistics. Fuel against food security concepts.	10
Recommended Leaning Resources		
Print Resources	**Text Books and References** 1) The Biodiesel Handbook (2005). Jurgen Krahl, Jon Harlan Van Gerpen.AOCS Press. 2) Bioenergy and Biofuels (2017).Ozcan Konur. CRC Press, Taylor & Franci's group. 3) https://mnre.gov.in/biofuels 1.	