

DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA

PG Diploma in
Biodiversity Conservation



SYLLABUS & COURSE HAND BOOK

w.e.f. January 2017

ABOUT THE DEPARTMENT

Department of Botany, University of Kerala, was established in the year 1959 at Kariavattom, Thiruvananthapuram, Kerala by Late Prof. (Dr.) A. Abraham, a visionary, an institution builder and a doyen in Cytogenetics and Plant Breeding. The Department actively serves the society through dissemination of knowledge and training the younger generation through unique courses and offering training in frontier areas of Plant Sciences. The Department is internationally known for its major contributions in Cytogenetics and Cytotaxonomy and for running a novel postgraduate programme in Genetics and Plant Breeding. The Department is also active in Plant Biotechnology research and has well established Cell/Tissue culture and Molecular Biology Laboratories. More than 140 students/teachers have taken PhD from the Department on various and diverse topics and more than 230 students have successfully completed their M. Phil programme in Advanced Botany.

The Vision....

- To serve the society through dissemination and field orientation of knowledge and training the best talents in Plant Sciences.

The Mission....

- To provide quality education in Life Sciences
- To develop human resources with hands on experience on basic/ applied Plant Science research
- To act as a Centre for mining of biomolecules, genes and technologies of immense practical application for human welfare
- To undertake basic, strategic and applied research for generating fool-proof technologies for the advancement of plant science and
- To become a Center of Excellence in Plant Science teaching and research in next five years

Courses Offered

M.Sc Genetics and Plant Breeding: A unique course with superb amalgamation of classical and applied aspects of Plant Science.

M.Phil. Advanced Botany: Two-semester programme covers Methods in Research, Advanced topics in Botany, Plant Breeding and Biotechnology. A project work as partial fulfillment of the course, term papers and seminars are the major attractions of the Course.

PhD Botany: Areas of Research

- Biosystematics, Plant Taxonomy
- Plant Biotechnology/ Tissue Culture/ Cell Culture Technology
- Phytochemistry, Plant Reproductive Biology

Admission Procedure

PhD Admission: is scheduled in January/ July. Qualification: M.Phil. PhD Qualifying Test, UGC-CSIR NET/KSCSTE Fellowship

M. Phil Advanced Botany: The Course begins in November 1st. Admission based on Entrance Examination (50%) with 50% for the Masters Degree.

M.Sc Genetics and Plant Breeding: Admission based on an Entrance Examination held in May every year. 50% of marks for Graduate Degree and 50% for the entrance test.

Faculty

1. Dr. S. Suhara Beevy Associate Professor & Head
2. Prof (Dr.) Ashalatha S. Nair
3. Prof (Dr). P.M. Radhamany
4. Dr. T.S. Swapna
5. Dr. M. Kamarudeen
6. Dr. A. Gangaprasad
7. Dr. E.A. Siril
8. Dr. Bindu R. Nair
9. Dr. R. Rajalakshmi

Research Activities

- Conservation of Tropical Plant Diversity, Evaluation and Genetic characterization
- Biosystematics and Evolution
- Chemical / Gene prospecting
- Crop Genomics
- Plant Tissue Culture and Molecular Biology of Medicinal and Crop Plant relatives
- Cytogenesis, Cytotoxicity and Cytotaxonomy
- Plant Reproductive Biology, Breeding and Palynology

Facilities available

1. Botanic Garden: Well-maintained, fully organized garden, member of Botanic Garden Conservation International (BGCI). The garden includes medicinal plant conservatory, nurseries, green houses, water plant conservatories, horticulture and topiary garden.

2. Herbarium: Department herbarium has a collection of 6000 Angiosperm specimens from Western Ghats, 21 Gymnosperms and 715 Pteridophytes.

3. Library and Information Services: The Department Library has over 15,000 books and 15 subscribed National and International journals. The library provides INFLIBNET and science@direct facility.

4. Molecular Biology Laboratory Facility: A centralized lab facility established through KSCSTE-SARD, DST-FIST, and UGC Plan fund with modern sophisticated equipments. Some of the important equipments are; Cryostat, ELISA reader, Fluorescence microscope, Gas chromatography unit, Gel documentation, Gel electrophoresis vertical and horizontal, High speed centrifuges, HPLC unit, Image analyzer, Lyophilizer, PCR, Phase Contrast Microscope, Stereomicroscope, UV-VIS Spectrophotometer, protein purification system, biophotometer etc...

5. Computer lab facility: Established through DST-FIST Programme. Computers with high speed broadband internet connection and LAN facility. INFLIBNet facility is provided for deep literature search.

6. Department Auditorium: Department has an auditorium (A/C) with modern Audio Visual Facility.

The Kerala University Botany Alumni Association (KUBAA)

The Botany Department of the University of Kerala is located in the Kariavattom Campus, about 14kms from the Thiruvananthapuram city. It was established in 1959 by the late Prof. (Dr.) A. Abraham. Since its inception, the Department has been focusing its attention mainly on PhD programmes and other research activities. The main activity of the Department is to undertake research projects and guide researchers for PhD and M. Phil degrees. Dr. S. Suhara Beevy is the present Head of the Department. Kerala University Botany Alumni Association (KUBAA) was established in the year 2003. The Association has around 150 members who actively participate and generously contribute to all its activities. The Alumni Association proposes to conduct annual seminars with a view to encourage and enhance the interactions between its many members. It may thus serve as a platform for the exchange of ideas, both academic and social, by its members, thus effectively reduce the generation gap between the older acclaimed scientist and today's young researchers. The Alumni Association is proud to announce that many of the members of the Association are working in reputed research labs, across the country and abroad. Some of them frequently visit the Department, hold discussions with the students and even provide numerous valuable insights. Furthermore, the Alumni Association encourages their members to exchange their expertise and ideas among themselves and to the students of the Department, thereby providing scope for the generation of new ideas which may act as an impetus to research as whole.

For membership and other details please Contact:-

Professor & Head

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PG Diploma in Biodiversity Conservation

The PG Diploma programme in Biodiversity conservation shall be for one calendar year with two semesters of six months duration starting from 1st November every year and ending on 31st October in the subsequent year.

There shall be 8 core courses (4 credits each) and 2 elective courses (1 credit each). Students may choose any two electives, one in each semester. The course shall include workshops, study tours, field trips and seminars, which will be evaluated during continuous assessment. Examinations shall be conducted at the end of each semester. The details of the programme and scheme of examination are as shown below

Scheme of Examination

Semester	Course code	Title	No. of credits	Hours per semester	ESA	Maximum marks		Total marks
						CA	ESA	
I	BOT BC-01	Introduction to Biodiversity	4	106	3h	40	40	80
	BOT BC-02	Introduction to Conservation Biology	4	106	3h	40	40	80
	BOT BC-03	Ecology and Environment	4	106	3h	40	40	80
	BOT BC-04	Plant Systematics	4	106	3h	40	40	80
	BOT BC- E-01/02	Ecological Informatics/ Phylogenetics	1	26	3h	40	40	80
II	BOT BC-05	Animal Diversity	4	106	3h	40	40	80
	BOT BC-06	Conservation and Sustainable Use of Biodiversity	4	106	3h	40	40	80
	BOT BC-07	Western Ghats Biodiversity and Conservation	4	106	3h	40	40	80
	BOT BC-08	Environmental Frameworks and Policies	4	106	3h	40	40	80
	BOT BC- E-03/04	Remote Sensing Applications/Climate Change and Crop Adaptations	1	26	3h	40	40	80
Total								800

Final result shall be graded as follows

Grade A: 60% and above

Grade B: 50% and above but below 60%

Failure: Below 50%

CORE COURSES
BOT BC-01. Introduction to Biodiversity
No. of Credits – 4

Unit 1. Introduction Definition: Genetic diversity, Species diversity, Ecosystem diversity: Structural and functional aspects. Bio-geographic classification of India

Unit 2. Value of Biodiversity: Intrinsic, consumptive, productive use, social, ethical, aesthetic and option values. Utilitarian values of biodiversity-goods, services and information. Biodiversity and ecosystem functioning. Biodiversity and stability of ecosystem functioning. Biodiversity at global, national and local levels India as a Mega Diversity Nation Hotspots of Biodiversity: Criteria for determining hot spots. Indo-Burma (Eastern Himalaya), Western Ghats and Sri Lanka.

Unit 3. Threats to Biodiversity: Habitat loss, pollution, species introduction, global climate change, overexploitation, poaching of wildlife. Rare species, genetic diversity of rare species, habitat loss and fragmentation. Extinction: mass extinction, extinction process, ecosystem degradation, over exploitation, invasive species. Human factors: social factors, economics, politics and action. Man-wildlife conflicts. Endangered and endemic species of India, common plant species, common animal species.

Unit 4. Conservation of Biodiversity: Strategies for conservation: In-situ and *ex-situ* conservation-environmental assessment, protected areas-biosphere reserves, national parks, sanctuaries, tiger reserves-project tiger. *Ex situ* conservation-Managed ecosystems, biological resources and gene banks, botanical gardens, bio-parks, simulated *ex situ* conservation strategies, valuing biological resources, ecotourism, Role of IUCN, Biodiversity International, IPGRI, WWF, FAO, BSI, ZSI, NBPGR, NBFGR, NBAGR, NFPTCR in conservation.

Suggested Readings

Huston, M.A. (1994). Biological Diversity: The coexistence of species on changing land scapes. Cambridge University Press, UK.

Krishnamurthy, K.V. (2003). Text book on Biodiversity, Science Publishers, New Hampshire.

Leveque, C. & J. Mounolou (2003) Biodiversity. New York: John Wiley. ISBN 0-470-84957-6

Margulis, L., Dolan, Delisle, K., Lyons, C. Diversity of Life: The Illustrated Guide to the Five Kingdoms. Sudbury: Jones & Bartlett Publishers. ISBN 0-7637-0862-3

Novacek, M. J. (ed.) (2001) The Biodiversity Crisis: Losing What Counts. New York: American Museum of Natural History Books.

Shahid N., Daniel E. Bunker, A.H., Michel L. and Charles Perrings (2009). Biodiversity, Ecosystem Functioning, and Human Wellbeing An Ecological and Economic Perspective, Oxford University Press, New York.

Sharma P.D. (2003). Ecology and Environmental Sciences, Rastogi Publications, Meerut, India

Wilson E.D (1999). Diversity of Life. W.W. Norton, USA.

Model question paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
First Semester
PG Diploma in Biodiversity Conservation Examination
BOT BC-01. Introduction to Biodiversity

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. Define genetic diversity
2. Give the year in which Project Tiger launched
3. What is the wildlife symbol of WWF?
4. Which sanctuary in Kerala was described as the richest bird habitat on peninsular India by Dr. Salim Ali?
5. Expand CITES.
6. Name a recently extinct species.
7. Name the national park famous for one-horned rhinoceros
8. Which day is celebrated as 'World environment day'?
9. Name two endangered animal species of India
10. Name the first biosphere reserve in India

(10X1= 10 marks)

II. Answer any five questions. Each answers not exceeding 50 words.

11. What is the difference between rare and exotic species?
12. What is co-extinction? Give suitable examples.
13. Explain how the invasion by an alien species reduces the species diversity of an area.
14. What is endemism? List any three endemic plant and animal species of India.
15. Give an account of the international organizations involved in the conservation of wildlife
16. Define biosphere reserve. Name the three zones of a biosphere reserve and the activities permitted in each.
17. Differentiate alpha, beta and gamma diversity?

(5X2= 10 marks)

III. Answer any four of the following. Each answer not exceeding 150 words

18. Describe the consumptive value of biodiversity as food, drugs & medicines, and fuel & fiber with suitable examples.
19. How does species diversity differ from ecological diversity?
20. Write an explanatory note on the efforts for conservation of biodiversity in India
21. What do you mean by hot spots of biodiversity? What are the criteria for identifying hot spots and name the biodiversity hotspots located in India
22. Explain the major threats to biodiversity?
23. Describe the different IUCN red list categories of species according to the basis of degree of threat?

(4X3= 12 marks)

IV. Answer any one of the following, not exceeding 350 words

24. Describe the various in situ and ex situ conservation strategies
25. Explain briefly about the biogeographical zones of India giving emphasis to the corresponding flora and fauna of each of them

(1X8= 8 marks)

BOT BC-02. Introduction to Conservation Biology

No. of Credits - 4

Unit 1 – Introduction: Basic concepts of conservation biology, history of conservation biology, the value of biodiversity and conservation, current practice in conservation, conservation of genetic diversity, conservation of species diversity, conservation of ecosystem diversity, relevance of ecosystem diversity as well as services in conservation.

Unit 2 - Strategies for Conservation: Top-down and bottom- up protocols for conservation.– *in situ* conservation. Protected areas, Wildlife sanctuaries, National parks, Biosphere reserves, mangrooves. Strategies for *ex situ* conservation – Botanical Gardens, Seed banks, Field gene banks, Test tube gene banks, pollen banks, DNA bank, *in vitro* conservation.

Unit 3 - Ecosystem Restoration and Management Practices, Global biodiversity and its importance, Different approaches of biodiversity conservation and management, registering biodiversity. Valuing biodiversity resources and their contribution to agriculture, community health and environment. Causes of biodiversity loss. Techniques of species reintroduction and restoration of the degraded habitat. Biodiversity policy and legislation. Wildlife conservation and management: Status of biodiversity conservation in India.

Unit 4 - Current Practice in Conservation in India and World. Organizations involved in resource conservation IUCN, WWF, UNEP, UNESCO. Phytogeography – Hotspots of India and world. General account on activities of DBT, BSI, NBPGR, ZSI, FSI, NBFGR and NBAGR. Sacred groves, Biodiversity register.

Suggested Readings

- Gabriel M. (2000) Biodiversity and conservation Oxford and IBH publishing company Pvt Ltd. New Delhi.
- Heywood, V.H. & Watson, R.T. (1995) Global Biodiversity Assessment.
- Iriondo, J. M., Maxited, N. and Dulloo, M.E (2008) Conserving plant genetic diversity in protected areas – population management of crop wild relatives. Biddles Ltd. Kings' Lynn.
- Krishnamoorthy, K.V (2004) An Advanced text book on Biodiversity- principles and Practice: Oxford and IBH publishing company Pvt. Ltd. New Delhi.
- Kumar, U. and Sharma, A.K (2008) Plant Biotechnology and Biodiversity conservation. Agrobios India.
- Negi, S.S. (1993) Biodiversity and its Conservation in India.
- Fiedler P.L and Kareiva, P.M. (1997) Conservation biology Chapman and Hall International Thompson Publishing.USA
- Primack, R.B. (1993) Essentials of Conservation Biology. Kluwer Academic Publishers, Dordrecht
- Swaminathan, M.N. & Jain, R.S. (1982) Biodiversity: Implications for global security, Macmillan,1982.
- Trivedi, P. C. 2007 Global Biodiversity status and conservation. Pointer publishers Jaipur India.

Model question paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
First Semester
PG Diploma in Biodiversity Conservation Examination

BOT BC-02. Introduction to Conservation Biology

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. Define a cryobank
2. Where is the NBPGR headquarters located?
3. What is a keystone species?
4. Name a botanical garden in India
5. What are the zones of a biosphere reserve?
6. Define genepool
7. What is alpha diversity?
8. Define threatened species
9. When is wildlife week celebrated in India
10. Expand UNEP

(10X1= 10 marks)

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Distinguish between umbrella species and flagship species?
12. Compare the Top down and bottom up approaches of conservation?
13. What is ecosystem service? Give its relevance in conservation of biological resources?
14. What are the three categories of threatened species?
15. Explain the role of genetics in conservation biology.
16. What are protected areas of conservation?
17. Give the ecological role of mangroves?

(5X2= 10 marks)

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. What are sacred grooves and their role in biodiversity conservation?
19. Describe the major anthropogenic activities causing threat to biodiversity.
20. Differentiate between a National Park and a Wildlife sanctuary?
21. Give an account of the techniques for restoration of degraded habitats?
22. Write a short account on Project Tiger.
23. What are biosphere reserves? List out the biosphere reserves in India along with their location.

(4X3= 12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. Discuss the ex situ conservation strategies.
25. Explain briefly about biodiversity hotspots. How many hotspots are there in the world? List them all.

(1X8= 8 marks)

BOT BC-03. Ecology and Environment

No. of Credits - 4

Unit 1 - Fundamental Aspects of Ecology: Definition of ecology, natural ecosystems, Species and individuals, population parameters and population growth, structure and composition, alpha, beta, gamma diversity and dominance, concept of carrying capacity, population fluctuation and regulation.

Unit 2 – Ecosystem, Ecosystem Analysis and Environment Ecosystems and Natural Communities: Individuals and populations, Population ecology, Habitat ecology, landscape ecology, people ecology, ecosystem ecology, plant- animal interactions, ecosystem management and conservation. Biogeographic regions of India and world, endemic and endangered species, major biomes of India and the world, major terrestrial, aquatic and marine ecosystems of India and world. Western Ghats agro-ecological and floristic zones- and forest types of India.. Litter production and decomposition in different ecosystems

Unit 3 - Population & Community Dynamics Autecology and population dynamics, ecological life cycle, ecotype differentiation, population characteristics and dynamics-k selection, species interaction- intra and inter specific competition, evolutionary consequences of competition, allelopathy and keystone species. Synecology and community dynamics, methods and purpose of studying plant communities, species-area curve, ecological sampling of an area, quantitative structure of plant, communities, ecotone, Habitat, ecological niche, ecological equivalents, sympatry and allopatry, natural selection, artificial selection. Dominance and diversity, ecological succession and climax, successional models. Structure and composition of community, recruitment and mortality community coefficients, cluster analysis, association analysis, gradient analysis, vegetation mapping.

Unit 4 - Functional Aspects of Ecosystem Ecosystem components and structure -abiotic and biotic factors, trophic relations, influences of climatic factors on major ecosystems of the world, food chains and edaphic factors, functional aspects: biomass and productivity-primary production, gross and net production, estimation methods, food chain, food webs, trophic levels and ecological pyramids. Ecological and social impact of resource depletion, loss of biological diversity, land degradation, deforestation, cybernetics & homeostasis, Environmental Impact Assessments.

Suggested Readings

Chapman, J. L. and Reiss M. J. (2004) Ecology-Principles and Applications-(2nd Edn.) Cambridge University Press

Chatwal, G.R and Sharma, H. (2004) A Text Book of Environmental Studies: Environmental Sciences Himalaya Publishers, New Delhi

Devis, M (2007) Biodiversity and Environmental Conservation: Arise Publications, New Delhi

Dubey, S. K. (2006) A Textbook of Ecology, S. Chand Publication, New Delhi

Hong, S.-K.; Lee, J.A.; Ihm, B.-S.; Farina, A.; Son, Y.; Eun-Shik, K.; Choe, J.C (2004) Ecological Issues in a Changing World Edited by Springer-Verlag, Heidelberg

Kumar, H.D (1995) Modern concepts of Ecology, Vikas Publishing House, NewDelhi

Myers, J and Bazly, D. (2005) Ecology and Control of Introduced Plants Edited Cambridge University Press

Prasanthrajan, M and Mahendran, P P (2008) A Text Book on Ecology and Environmental Science: Agrotech Publishers, New Delhi

Schulze, E.D., Beck, E. Hohenstein, K.M. (1995) Plant Ecology, Springer-Verlag, Heidelberg

Townsend, C.R., Begon, M., Harper J.L. (2005) Essentials of Ecology, 3rd Edition Wiley-Blackwell Publishers, London, New York

Vogt, K., Patel-Weynand, T., Witten, E., Gordon, J., Wargo, J., Vogt, D., Asbjornsen, H., Palmiotto, P. A., Clark, H. J., O'Hara, J. L., Keaton, W. S. (1997) Ecosystems - Balancing Science with Management Springer-Verlag, Heidelberg

Model question paper

DEPARTMENT OF BOTANY

UNIVERSITY OF KERALA

First Semester

PG Diploma in Biodiversity Conservation Examination

BOT BC-03. Ecology and Environment

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. What is gamma diversity ?
2. Ecological niche
3. Define an ecosystem
4. Define autecology
5. What is allelopathy ?
6. What is vegetation mapping?
7. Define community coefficient
8. What is a species ?
9. What is homeostasis ?
10. What is a food web ?

(10X1= 10 marks)

II. Answer any five questions. Each answers not exceeding 50 words.

11. A brief account on carrying capacity
12. What is food chain with example?
13. Write a short note on EIA
14. What causes deforestation?
15. What are the uses of forest resources?
16. Differentiate ecotype and ecotone
17. What is species area curve?

(5X2= 10 marks)

III. Answer any four of the following. Each answer not exceeding 150 words

18. How sustainable developments improve quality of life?
19. Describe types of ecological pyramid and illustrate for an ecosystem?
20. Enumerate different types of natural resources
21. How environmental studies help you to live healthy and safely?
22. A brief account on major biomes in India
23. Write an account on sympatry and allopatry

(4X3= 12 marks)

IV. Answer any one of the following, not exceeding 350 words

24. Explain the ecological and social impacts of resource depletion in different Ecosystems
25. Explain population dynamics with special reference to inter and intra specific competitions in a community

(1X8= 8 marks)

BOT BC-04. Plant Systematics

No. of Credits 4

Unit 1. Introduction: Systematics: An overview, Angiosperm Phylogeny Group (APG) classification of flowering plants; Botanical Nomenclature: ICBN - Salient features, Principles, Important Rules and Recommendations, Phylocode system . Taxonomic tools : Herbarium, floras, taxonomic keys, Botanical gardens, Computers, GPS, GIS. Systematic literature, herbaria, electronic data bases.

Unit 2. Taxonomy & Biodiversity: A comparative study of the following pairs of families and their treatment in recent systems:

a) Magnoliaceae & Winteraceae, b) Malvaceae & Sterculiaceae, c) Rutaceae & Meliaceae, d) Apocynaceae & Asclepiadaceae, e) Verbenaceae & Lamiaceae, f) Amaranthaceae & Chenopodiaceae, g) Cyperaceae & Poaceae.

Importance of Taxonomy in Biodiversity and conservation and exploitation of Bioresources. Rules and regulations in biological classification, IUZS, ZSI, FSI

Approaches in animal taxonomy- External morphology, anatomical approach, approaches based on developmental biology, Molecular taxonomy and biochemical approach, karyological, numerical, ecological and ethological taxonomy

Unit 3. Biosystematics: Significance and applications of Biosystematics. Sources of plant systematics: Morphological data (floral and foliar). Data from anatomy, embryology, palynology, cytogenetics, phytochemistry, reproductive biology and ecology; Application of serological and biochemical data

Unit 4. Molecular systematics: Introduction, Different methods and molecular markers in plant systematics, concepts of gene trees, species trees, monophyly, paraphyly and molecular evolution, practical aspects and applications of molecular systematics.

Numerical taxonomy: Principles and status of numerical taxonomy, Aims and objectives and nomenclature. Merits and demerits of numerical taxonomy. Applications of numerical taxonomy

PRACTICALS:

1. Study of at least 25 locally available families of flowering plants
2. Description and identification at family, genus and species levels using Floras.
3. Identification of genus and species of locally available wild plants and medicinal plants
4. Preparation of herbarium sheets of any 25 plants belonging to different families
5. Field trips in and around Kerala, compilation of field notes and preparation of herbarium sheets (25) of such plants.
6. Botanical excursion of about one week duration to any botanically rich location preferably outside the State.

Suggested Readings

Cronquist, A. (1981) An Integrated system of Classifications of flowering plants. Columbia University Press, New York

- Davis, P. H. and V. H. Heywood (1991) Principles of Angiosperm Taxonomy. Today and Tomorrow Publications, New Delhi
- Hulchinson, J. (1959) Families of flowering plants
- Judd, W. S., Campbell, C. S., Kellogg E. A. and Stevens, P. F. (2002) An Integrated System of Classification of Flowering Plants (2nd edition)
- Judd, W.S. *et al.* (2002) Plant Systematic- A Phylogenetic Approach – 2nd Edition. Sinauer Associates Inc. Publishers Sunderland. Massachusetts, U.S.A.
- Lawrence George H. M. (1951) Taxonomy of vascular plants Oxford and IBH Publ. Co. Pvt. Ltd., New Delhi
- Manilal, K. S. and M. S. Muktesh Kumar (ed.) (1998) A Hand book of Taxonomy Training, DST, New Delhi
- Naik, V. N. (1984) Taxonomy of Angiosperms Tata McGraw-Hill Publication Com. Ltd., New Delhi
- Primak, R. B. (2004) A Primer of Conservation Biology. Sinauer Associales, Inc. Publishers
- Quicke, Donald, L. J. (1993) Principles and Techniques of Commemorative Taxonomy. Blakie, Academic and Professional, London
- Simpson, M. (2005) Plant Systematics. Elsevier Press, Amsterdam.
- Singh, G (2004) Plant Systematics: Theory and practice Oxford and YBH Publishing Co. Pvt. Ltd., New Delhi.
- Singh, G. (2004) Plant Systematics- Theory and Practice. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
- Stace, C. A. (1989) Plant. Taxonomy and Biosystematics. Edward Arnold, London.
- Stuessy T. F. (2002) Plant taxonomy. The systematic Evaluation of comparative data. Bisen Singh Mahendra Pal Singh, Dehra Dun.
- Stuessy, T.F. (1990) Plant Taxonomy; Plant Systematics – A Phylogenetic Approach 2nd edn. Blackwell Publications, New York
- Taylor, D. V. and L. J. Hickey (1997) Flowering plants: Origin, Evolution and Phylogeny CBS Publishers a Distributors New Delhi.

Model question paper

**DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA**

First Semester

PG Diploma in Biodiversity Conservation Examination

BOT BC-04. Plant Systematics

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. What is biosystematics ?
2. Homoplasy
3. What is APG ?
4. Define Herbarium
5. What is karyological taxonomy ?
6. What is a gene tree ?
7. What is OTU's ?
8. Define serotaxonomy
9. ICBN
10. FSI

(10X1= 10 marks)

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Briefly explain taxonomic keys
12. Differentiate GPS and GIS
13. Briefly explain the concept of species trees
14. Briefly explain the significance of Biosystematics
15. What are the importance of Botanic gardens in taxonomic studies ?
16. Importance of palynology in taxonomic studies
17. A brief account on IUZN

(5X2= 10 marks)

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Differentiate ecological and ethological taxonomy
19. Importance of morphology in taxonomic studies with examples
20. Differentiate monophylic and paraphylic conditions
21. What are the applications of molecular systematics ?
22. What are the rules and regulations of biological classifications ?
23. Write notes on the importance of taxonomic studies in biodiversity conservation

(4X3= 12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. Define numerical taxonomy and what are its applications in modern taxonomic studies
25. Compare the floral features of the families Apocynaceae and Asclepiadaceae based on recent systems of classification

(1X8= 8 marks)

BOT BC-05. Animal Diversity

No. of credits - 4

Unit- 1: Animal diversity: Lower invertebrate phyla

General Characters – Strictly restrict to salient features only

Classification up to Classes with two or three examples – Brief account only

Kingdom Protista: General Characters and Classification up to classes; Locomotory Organelles and Locomotion in Protozoa

Phylum Porifera: General Characters and classification up to classes; Canal System in Porifera

Phylum Cnidaria: General Characters and classification up to classes; Polymorphism in Hydrozoa

Phylum Platyhelminthes: General characters and classification up to classes; Life history of Taenia solium

Phylum Nematelminthes: General characters and classification up to classes; Life history of Ascaris lumbricoides and its parasitic adaptations

Unit- 2: Animal diversity: Higher invertebrate phyla

General Characters – Strictly restrict to salient features only

Classification up to Classes with two or three examples – Brief account only

Phylum Annelida: General characters and classification up to classes; Metamerism in Annelida

Phylum Arthropoda: General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects

Phylum Mollusca: General characters and classification up to classes; Torsion in gastropods

Phylum Echinodermata: General characters and classification up to classes; Water-vascular system in Asteroidea

Protochordates: General features and Phylogeny of Protochordata

Unit- 3: Animal diversity-phylum: Chordata

General Characters – Strictly restrict to salient features only

Classification up to Classes with two or three examples – Brief account only

Agnatha: General features of Agnatha and classification of cyclostomes up to classes

Pisces: General features and Classification up to orders; Osmoregulation in Fishes

Amphibia: General features and Classification up to orders; Parental care

Reptiles: General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes

Aves: General features and Classification up to orders; Flight adaptations in birds, Birds Songs

Unit- 4: Animal diversity-phylum: Mammalia

General Characters – Strictly restrict to salient features only

Classification up to Classes with two or three examples – Brief account only

Mammalia-I: Classification and characters with suitable examples; oviparity; ovoviviparity and viviparity in mammals.

Mammalia-II: Dentition; adaptive radiation; convergent evolution of placental and Australian mammals, Primates, Classification of living Primates, Specific features of Anatomy, Physiology and Morphology, Unique Behavioral characters in Primates

Suggested Readings

- Bhatnagar, M.C and Bansal, G (1998) Non chordata (invertebrate zoology), Krishna Prakashan Media (P) Ltd., Meerut, New Delhi.
- Chaudhary, A.B. and Sarkar, D.D. (2003) Mega Diversity Conservation, Daya Publishing House, New Delhi.
- Cyril, R. and Perkins, L. (2009) Vertebrata. General books, LLC
- Deshmukh (1986) Ecology and Tropical Biology, Blackwell Scientific Publication, New York
- Jordan, E .L. and Varma, P.S (1967) Chordate Zoology, S Chand and Co. Pvt. Ltd., New Delhi
- Lloyd, J.R. (1984) Man and the Ecosystem, Macmillan Education Ltd., London
- Mani, M.S (2004) Progress in Invertebrate Zoology.
- Mayr, E and Lock, P.D.A (1991) Principles of Systematic Zoology. Mc Graw Hill Publ. Co., Singapore
- Narendran T. C. (2000) An Introduction to Taxonomy. Zoological Survey of India, Kolkata, India.
- Odum, E.P (1996) Ecology-A Bridge between Science and Society, Sinauer Associates Inc.
- Ormond et. al. (2004) Marine Biodiversity, Cambridge University Press
- Sharma, B.D (2002) Indian Wildlife-Threats and Preservations, Anmol Publications Pvt. Ltd., New Delhi.
- Sinha, R.K. and Singh, D. (1997) Global Biodiversity, INA Shree Publishers, NewDelhi

Model question paper
DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
Second Semester
PG Diploma in Biodiversity Conservation Examination

BOT BC-05 Animal Diversity

Time: Three hours

Maximum marks: 60

I. Answer all questions in one word or sentence

1. The Larvae of *Ambystoma* is known as-----?
2. Major Function of Cnidocytes?
3. The major distinguishable feature of Vertebrate is?
4. Ray-Finned Fishes also known as
5. Sponges' classification categories based on-----?
6. Malpighian Tubules Present in-----?
7. Jawless fishes are called ----?
8. Eutherians can be Characterized by
9. The secretion of skin gland *Bufo Melanostictus* produce a compound called...?
10. Cobra venous is----?

(10X1= 10 marks)

II. Answer any five questions. Each answers not exceeding 50 words.

11. Polymorphisms in Cnidarians?
12. Reproduction in Sponges?
13. Major Features of Echinodermata?
14. What is Ommatida?
15. Osmoregulation Mechanisms in Aquatic Fishes?
16. Lung Fishes and their Unique Features?
17. Classifications of Living Amphibians?

(5X2= 10 marks)

III. Answer any four of the following. Each answer not exceeding 150 words

18. Explain Canal Systems in Sponges?
19. Discuss the Locomotory and Feeding Organs in Protozoans
20. Briefly explain Unique Behavioral responses in Primates
21. Flight Adaptations in Birds Explain with Examples?
22. Discuss the Biting Mechanisms in Snakes?
23. Different types Metamorphosis Explain with Examples?

(4X3= 12 marks)

IV. Answer any one of the following, not exceeding 350 words

24. Elaborate the Life Cycle of *Ascaris lumbricoides* and their parasitic adaptations?
25. Elaborate Mammalian Classifications and their Unique Features?

(1X10= 10 marks)

BOT BC-06. Conservation and Sustainable Use of Biodiversity

No of credits - 4

Unit 1. Biodiversity Types of Biodiversity, Genetic Diversity, Species Diversity, Ecosystem Diversity, Agro Biodiversity, Ecosystem stability, Biogeographical classification of India Value of Biodiversity- consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at different levels: Biodiversity global, National and local levels India as a mega- diversity nation Hot spots of Biodiversity.

Unit 2. Ecosystem Diversity in India- Desert ecosystem, Arid zone, Forest ecosystem, Grass lands, Wetland, Mangroves Threat of Biodiversity: Habitat loss, Loss of Genetic Diversity, Loss of Species diversity, Exotic species, Genetic pollution, genetic erosion, , poaching of wildlife, man wildlife conflicts, climate change and global warming on biodiversity Endangered, Threatened and endemic species of India Loss of Ecosystem Diversity, Loss of Agrobiodiversity.

Unit 3. Conservation of Biodiversity Types of conservation *In situ* conservation facility conservation strategy- conserving genetic diversity in protected areas- endangered flora and fauna-wild life sanctuaries, National parks, Biosphere reserve, project Tiger, Project Elephant, Conservation outside protected areas. *Ex situ* conservation-Botanic garden, Park, Global importance of medicinal plants, Reasons for their conservations, History, importance, present status and future prospects of medicinal crops, Ethnomedicinal plants of India and Western Ghats Ethnobotanical documentation of germplasm of medicinal value and their conservation Social approaches to conservation- Sacred Groves, People's movements for Biodiversity conservation, Chipko movement, Participatory forest management, Role of Universities and other educational institutions in Biodiversity conservation.

Unit 4. Biodiversity Conservation through Biotechnology Germplasm conservation using cell and tissue- mode of propagation, clonal , somatic embryogenesis, organogenesis, callus differentiation, *In vitro* storage of germplasm and cryopreservation, cryopreservation of microorganism, Application of *in vitro* conservation Other methods: Short term preservation, cold storage, low pressure and low oxygen storage, Genetic stability of *in vitro* conserved germ plasm, synthetic seed and biodiversity conservation, Limitations of *in vitro* conservation.

Suggested Readings

Bowles, M.L. and Whelan, C.J. (Eds.) (1996) Restoration of endangered species. Cambridge Univ. Press, Cambridge.

Duyan, P.J. (1990) Wetland Conservation: a Review of current issues and required action. IUCN, Gland, Switzerland.

Frankel, O.H., Brown, A.H.D. and Burdon, J.J. (1995) The Conservation of Plant Biodiversity, Cambridge Univ. Press, Cambridge

Ishwaran, N. (1992) Biodiversity, Protected Areas and sustainable Development. Nature and Resources Vol. 28; No.1

Krishnamoorthy, K.V (2004) An Advanced text book on Biodiversity- principles and Practice: Oxford and IBH publishing company Pvt. Ltd. New Delhi.

Kumar, U. and A.K Sharma (2008) Plant Biotechnology and Biodiversity conservation. Agrobios India.

Negi, S.S. (1993) Biodiversity and its Conservation in India. Bisen Singh Mahendrapal Singh, Dehra dun

Model question paper

**DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
Second Semester**

PG Diploma in Biodiversity Conservation Examination

BOT BC-06. Conservation and Sustainable Use of Biodiversity

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. Define Biodiversity
2. What is Chipko movement?
3. Define synthetic seeds
4. What is genetic erosion?
5. Define an exotic species
6. Define genetic diversity
7. Name a National park in Kerala
8. Define sacred groves
9. Name a threatened species of Western Ghats
10. Name an arid zone in India

(10X1= 10 marks)

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Distinguish between in situ and ex situ conservation.
12. Write an account on the short term preservation.
13. Briefly describe somatic embryogenesis
14. Differentiate between National Parks and Biosphere reserve.
15. What is endemism? Give examples of two endemic species of India
16. Give an account on the limitations of in vitro conservation.
17. Differentiate flora and fauna

(5X2= 10 marks)

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Write the significance of genetic stability analysis in in vitro conservation.
19. What are economic benefits mangroves?
20. Explain the role of educational institutions in biodiversity conservation.
21. What are the major causes of global warming?
22. Give an account on the Hot Spot of biodiversity
23. Briefly describe the role botanic gardens in biodiversity conservation.

(4X3= 12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. Explain the cryopreservation protocol for the germplasm conservation
25. Briefly describe the global importance of medicinal plants.

(1X8= 8 marks)

BOT BC-07. Western Ghats Biodiversity and Conservation

No of credits - 4

Unit 1. General Account on Western Ghats : A brief outline on geographic features, climatic and edaphic nature of Western Ghats, theories of origin of Western Ghats.

Unit 2. Biodiversity of the Western Ghats–Biodiversity in Western Ghats-Threats to biodiversity - Urbanization and Population .-Atmospheric pollution solid waste –Trafficking of wildlife products-Impact of intensive agriculture-plantations-aquacultures-industrialization on Biodiversity of Western Ghats. Impact of dams and other man made water reservoirs on biodiversity. Mining: Social and environmental impacts

Unit 3.Freshwater and Marine Biodiversity of South West coast of India: Marine biodiversity-marine algae, Freshwater Biodiversity-Freshwater alga, Overexploitation of estuarine and marine living resources, Coastal ecosystems - Coastal sand dune vegetation-Fish breeding and habitat-Freshland brackish water-Estuarine ecosystems-Mangrove -Mangrove communities –Wetlands.

Unit 4. Vegetation, Fauna and Agriculture: Vegetation: Forest type and distribution, Rain forests in WG, semi evergreen, deciduous, dry deciduous and other forest types-forests floral and faunal diversity-forest resources-utilization-management-major threats, Plants and lower form (fungi and bacteria etc...) diversity: Rare and endangered flowering plants - Medicinal and ornamental plant resources from the forest of Western Ghats,-Poisonous plants,-Edible mushrooms. Fauna: Invertebrates: Butterflies-Honeybees to conserve biodiversity-Mulberry Silkworms - Rice diversity and conservation in the WG-Conservation of traditional vegetables in the backyard Enriched biodiversity by plant introductions-Impact of introduced plants

Unit 5. Appreciating and Conserving Biodiversity: Biodiversity hot spot in Western Ghats-Conservatories and Bio-parks in Western Ghats-Biosphere reserves-sanctuaries-national parks in WG. Project tiger and other wider scale conservation programs in Western Ghats. Sacred groves. People's participation in Biodiversity Conservation. Biodiversity and the media-Role of non-government organizations in conservation.

Suggested Readings

Ali, S., Gururaja, K.V., Ramachandra, T.V. (2005) *Schistura Nilgiriensis* (menon) in Sharavathi river basin, western ghats, Karnataka, *Zoos' Print Journal*; 20: 1784-1785

Centre for Ecological Sciences (2005). *Conservation and Biodiversity*, Scientific Publications

CES (1993) *Biodiversity conservation in the Western Ghats: scientific contributions from Centre for Ecological Sciences*, Centre for Ecological Sciences, IISc, Bangalore

Daniels, R.J.R. (1997) *Taxonomic Uncertainties and Conservation Assessment of the Western Ghats*, *Current Science* 73: 169-170

Ecological Society (1985) *Pilot project in one of the critical areas of Western Ghats with a view to improve the quality of vegetation, check erosion and consequent silting up of an irrigation reservoir and also to demonstrate*, Ecological Society, Pune, Maharashtra, India

Fort Collins, U.S.A. (2002) *Impact of Rainforest Fragmentation on Small Mammals and Herpetofauna in the Western Ghats, South India, Final Report*, pp 146

Gadgil, M. (1996) *Western Ghats: A Lifescape*, *J. Indian Inst. Sci.* 76: 495-504

Ganeshiaiah, K.N.; Uma Shaanker, R., Bawa, K. S. (2001) (Ed.), Tropical ecosystems: structure, diversity and human welfare, Oxford & IBH, New Delhi

Gaonkar, H. (1996) Butterflies of the Western Ghats, India, Biogeography and Conservation Laboratory, The Natural History Museum, London

Gururaja, K.V., Arvind, N.A., Ali, S., Ramachandra, T.V., Velavan, T.P., Krishnakumar, V., Aggarwal, R.K. (2007) New species from the central Western Ghats of India, and its Phylogenetic position, Zoological Sciences 24: 252-534.

Harish G. (1996) Butterflies of the Western Ghats, India including Sri Lanka: a biodiversity assessment of a threatened mountain system, Centre for Ecological Sciences, IISc Bangalore

Hegade, M. (2000). Paschimaghattadajeevavaividhya (Biodiversity of Western ghats), Dr. Shivaram Karanth Adhyayana Kendra, Puttur

Hegde, S.N. (1982). Conservation of biological diversity of Western Ghats with special emphasis on animal genetics resource, Department of Biosciences, Mangalore University, Mangalagangothri, Mangalore.

Hussain, S.A., Achar, K.P. (1999) (Ed.) Biodiversity of the Western Ghats complex of Karnataka: resource potential and sustainable utilization, Biodiversity Initiative Trust, Mangalore

Menon, P. (1998). Biodiversity of Western Ghats: inventorying, monitoring and conserving the biodiversity of the Western Ghats through local people and colleges a case study, Centre for Ecological Sciences, IISc, Bangalore
Ministry of Environment and Forests (1998). Monitoring biodiversity: a pilot project, Ministry of Environment and Forests; Government of India

Nagendra, H. (1999) Biodiversity in the Western Ghats, GIS Development. India. Sep-Oct 1999. 3: 36&41

Prakash, G. (1985) Enquiry into the status of animal and plant life in critical areas of Western Ghats in order to evolve plan to conserve their biological diversity Vol.I., Ecological Society, Pune, Maharashtra

Pramod, P., Daniels, R.J.R.; Joshi, N.V.; Gadgil, M. (1997). Evaluating Bird Communities of Western Ghats to Plan for a Biodiversity Friendly Development, Current Science, 73, 156-162

Ranjit, R.J. (2004). Biodiversity in the Western Ghats, Wildlife institute of India, Dehra Dun, India.

Utkarsh, G. (1993). Biodiversity hotspots conservation programme: Western Ghats of Maharashtra; basis for proposals, RANWA

Wikramanayake, E.; Dinerstein, E., Loucks, C.J.; et al. (2002) Terrestrial Eco-regions of the Indo-Pacific: a Conservation Assessment. Island Press; Washington, DC.

Wildlife Institute of India (2003) Conservation of rainforests in India: wildlife and protected areas vol.4 No.1, 2003, Wildlife Institute of India, Dehra Dun

Websites:

- <http://www.biodiversityhotspots.org/xp/hotspots/ghats/Pages/default.aspx>
- http://wwf.panda.org/what_we_do/where_we_work/western_ghats/
- Western Ghats travel guide from Wikitravel

Model question paper

**DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA**

Second Semester

PG Diploma in Biodiversity Conservation Examination

BOT BC-07. Western Ghats Biodiversity and Conservation

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. Name two medicinal plants from Western Ghats.
2. Mention importance of Western Ghats in climate of Kerala.
3. Name two RET listed plants.
4. Write about wild edible mushrooms
5. Explain importance of Project Tiger.
6. What is PBR?
7. Write about sand dune vegetation
8. Mention importance of wetlands.
9. Write about economically important sea weeds
10. What are the importance of conservation of lower form.

(10X1= 10 marks)

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Write a short note on estuarine ecosystem
12. Explain Rice diversity.
13. Write about role of media in biodiversity conservation.
14. Give an account on Bioparks in Western Ghats
15. Explain importance of protection of butterflies in biodiversity conservation.
16. Give an account of trafficking of wildlife products
17. Mention importance of conservation of traditional vegetables

(5X2= 10 marks)

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Explain Pushpangadhan model in benefit sharing.
19. Explain marine biodiversity and its significance
20. Write an account on theories of Origin of Western Ghats.
21. Mention major threats to biodiversity.
22. Write about environmental impact of destruction of mangrove communities
23. Mention the importance of people's participation in biodiversity conservation.

(4X3= 12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. Give an account on Biodiversity hotspot in Western Ghats.
25. Explain distribution of major forest types in Western Ghats.

(1X8= 8 marks)

BOT BC-08. Environmental Frameworks and Policies

No. of Credits - 4

Unit 1. International Convention on Long –range Transboundary Air Pollution, Geneva 1979, Framework Convention on Climate Change, Kyoto Protocol-1997 Green house gas emissions. Montreal Protocol on substances that deplete ozone layer, Vienna Convention for the protection of the ozone layer, Vienna 1985. Rotterdam Convention - 1988 on the prior informed consent procedure for certain hazardous chemicals and pesticides in International trade, FAO International code of conduct on the distribution and use of pesticides, Rome 1985, Stockholm Convention on Persistent Organic Pollutants (POPs) 2001.

Unit 2. Marine Environment London Convention on the prevention of Marine Pollution by dumping of wastes and other matter-1972, Los Convention – United Nations Convention on the Law of the sea, Monligo Bay 1982. Marine Living Resources Convention for the conservation of Antarctic Marine living resources, Canberra 1980, Convention form the conservation of Antarctic seals, International convection for the conservation of Atlantic Tuna (ICCAT), Rio de Janeiro 1966, International Convention for the Regulation of Whaling, Washington 1946.

Unit 3. Nature Conservation Antarctic Treaty, Washington DC 1959, World Heritage Convention concerning the protection of the world cultural and Natural Heritage, Paris 1972, Convention on Biological Diversity (CBD), Nairobi 1992, CITES- Convention on the International Trade in Endangered species of Wild flora and fauna, Washington DC 1973, Ramsar Convention – on wetlands of International importance Ramsar, 1971, Convention to combat Desertification (CCD) Paris 1994. Cartagena protocol on Biosafety, Comprehensive Test Ban Treaty (CTBT).

Unit 4. National Regulations & policies: Constitution of India in relation to Environment, Forest (Conservation) Act 1980, Environmental (Protection) Act. 1986, Air (Prevention and control of pollution) Act 1981, Water (Prevention and control of pollution) Act 1974, Wildlife Protection Act 1972, Biological Diversity Act 2002, Hazardous waste (Management & Handling) Amendment Rules 2003, Water (Prevention and Control of Pollution) ACT 1974, The AIR (Prevention and Control of Pollution) Rules 1982. The National Environment Appellate Authority Act 1997, Recycled Plastic Manufacture and Usage Rules 1999, Municipal solid Waste Management Rule 20000, The Energy Conservation Act, Intellectual Property Rights, Scheme of labeling environmentally friendly products (ecomark), Kerala State Biodiversity Rules, National Forest Policy 1988, Wildlife conservation Strategy 2002, National Water Policy 2004, National Policy on Climate Change. Environmental Education Meaning and scope –Principles and objectives, Environmental awareness campaign, strategies, Formal and non-formal education- action plan.

Suggested Readings

Bhat C.P. (1987) The Chipko Andolan: In Agarwal, A. d'Monte, D; and Samanth U. (Eds.) . The fight for survival- Peoples Action for Environment. Centre for Science and Environment, New, Delhipp 43-56

Glowka, L; Burhenne-Guilmin F and Synge H. (1994) A guide to the Convention on Biological Diversity, IUCN, Gland, Switzerland

Model question paper

**DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
Second Semester**

PG Diploma in Biodiversity Conservation Examination

BOT BC-08. Environmental Frameworks and Policies

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. Write about Kerala State Biodiversity Rules.
2. Explain Water (Prevention & Control of Pollution) Act.
3. Expand CITES
4. Write about significance of Forest Conservation Act
5. What are Endangered species?
6. Mention importance of Stockholm convention.
7. Write about Convention for conservation of Antarctic Marine Living Resources
8. Explain CTBT
9. Give significance of Energy Conservation Act.
10. Write about Management of hazardous waste

(10X1= 10 marks)

II. Answer any *four* questions. Each answers not exceeding 50 words.

11. What are the major functions of National Appellate Authority?
12. Mention rules related to recycling of plastic
13. Write a note on importance of wetlands
14. What are the salient features of Cartagena protocol on Biosafety.
15. Write about an International Law preventing dumping of waste in marine environment.
16. Mention importance of Vienna convention.
17. Write about IPR

(4X2= 8 marks)

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. Write a note on Ramsar sites in Kerala.
19. Give an account on World Heritage Convention, Paris, 1972.
20. Write about Environmental education.
21. Write a short note on National Forest Policy.
22. Write about Ecomark.
23. Mention the significance of Convention on Biological Diversity

(4X3= 12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. Give an account on wildlife Protection Act, 1972 & Biological Diversity Act, 2002
25. Explain Kyoto protocol, 1997 and Montreal protocol.

(1X10= 10 marks)

ELECTIVE COURSES

BOT BC- E- 01. Ecological Informatics

No of Credits - 1

Unit 1 - Introduction: Ecological Applications of Fuzzy Logic, Artificial Neural Networks (ANN), Genetic Algorithms, Evolutionary Computation, Adaptive Agents. Classification of Ecological Images at Micro and Macro Scale - Identification of marine microalgae by neural network analysis of simple descriptors, age estimation of fish using a probabilistic neural networks, pattern recognition and classification of remotely sensed images by ANN

Unit 2 - Prediction and Elucidation of freshwater and marine Ecosystems by ANN: Development and application of predictive river ecosystem models, modeling ecological interrelations in running water ecosystems, dynamics and organizational informatics of benthic macro-invertebrate communities in streams, elucidation of hypothetical relationships between habitat conditions and macro-invertebrate assemblages in freshwater streams. A generic artificial neural network model for dynamic predictions of algal abundance in freshwater lakes, predictive rules for phytoplankton dynamics in freshwater lakes discovered by evolutionary algorithms, multivariate time-series prediction of marine zooplankton by ANN, classification of fish stock-recruitment relationships in different environmental regimes by fuzzy logic combined with a bootstrap re-sampling approach, Utility of sensitivity analysis by ANN Models

Bobbin, J. and Recknagel, F. (2001) Knowledge discovery for prediction and explanation of blue-green algal dynamics in lakes by evolutionary algorithms. *Ecol. Modelling* 146: 1-3, 253-264

Chon, T.S., Park, Y.S., Moon, K.H. and Cha, E.Y. (1996) Patternizing communities by using artificial neural network. *Ecol. Modelling* 90: 69-78

Lek, S., Delacoste, M., Baran, P., Dimonopoulos I., Laugam J. and Aulagnierm J. (1996) Application of neural networks to modelling nonlinear relationships in ecology. *Ecol. Modelling* 90: 39-52

Recknagel, F. (1997) ANNA - artificial neural network model predicting specie abundance and succession of blue-green algae. *Hydrobiologia*, 349: 47-57

Recknagel, Friedrich (Ed.) (2006). Ecological Informatics: scope techniques and applications Springer International Publishing

Smardon, R. (2009) *Sustaining the World's Wetlands - Setting Policy and Resolving Conflicts*

Straskraba, M. and Gnauck, A. (1985) *Freshwater Ecosystems: Modelling and Simulation*

Whigham, P. and Recknagel, F. (2001) Predicting chlorophyll-a in freshwater lakes by hybridising process-based models and genetic algorithms. *Ecol. Modeling* 146: 1-3, 243-251.

Whigham, P. and Recknagelm F. (2001) An inductive approach to ecological time series modelling by evolutionary computation. *Ecol. Modeling* 146, 1-3, 275-287

Model question paper

**DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA**

First Semester

PG Diploma in Biodiversity Conservation Examination

BOT BC- E- 01. Ecological Informatics

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. What constitutes the Benthos?
2. Define the Fuzzy approach for data interpretation
3. What is spatial information technology?
4. Name a neural network software.
5. What is a roulette wheel selection algorithm?
6. Give an example of a marine microalga.
7. What are adaptive agents?
8. What is a generic artificial neural network?
9. What are the constituents of a stream ecosystem?
10. What is Pattern recognition?

(10X1= 10 marks)

II. Answer any five questions. Each answers not exceeding 50 words.

11. Name and explain a technique for ecological data acquisition
12. Write a brief account on river flow forecasting using artificial neural networks.
13. Compare the freshwater and marine ecosystems.
14. What is the purpose of a selection algorithm.
15. What is the utility of randomization and re-sampling technique
16. What is the difference between phytoplankton and zooplankton?
17. Explain the application of predictive river ecosystem models

(5X2= 10 marks)

III. Answer any four of the following. Each answer not exceeding 150 words

18. Give an overview on the Genetic algorithms. What are its applications?
19. Explain the hypothetical relationships between habitat conditions and macro-invertebrate assemblages in freshwater streams.
20. What is meta-analysis? How does the analysis help in ecological studies?
21. Explain the microalgal abundance modeling with ANN.
22. What is a multivariate time series prediction? Explain the utility of the method.
23. How does sensitivity analysis of a model system help in predictions?

(4X3=12 marks)

IV. Answer any one of the following, not exceeding 350 words

24. Explain the design and application of computational methods for ecological analysis.
25. Describe how ecological informatics helps in the management of ecological problems such as habitat degradation and biodiversity conservation.

(1X8= 8 marks)

BOT BC- E- 02. Phylogenetics

No of credits - 1

Unit 1. Introduction Phylogeny and taxonomy; Choice of characters, Data matrices: molecular & morphological Gene trees and species trees- rooted vs. unrooted trees, ultrametric vs. unconstrained, Concept of homology -paralogy vs. orthology. Inferring phylogenies - Distance Methods, Character State reconstruction, Exhaustive search method, Stepwise clustering method, UPGMA and WPGMA neighbor-joining; Maximum Parsimony: Consensus trees, Tree searching algorithms - PAUP, Maximum likelihood: Systematic versus random error, Fitch Margoliash method, Bremer support index, parametric Bootstrapping and Jack Knifing

Unit 2. Sequence Data Bases and Hypothesis Testing General nucleic acid and protein sequence data base, Specialized and Non redundant sequence data bases, Database documentation search, ENTREZ, BLAST, Pairwise and Multiple Sequence Alignment algorithms, progressive alignment- Clustal, MALIGN, POY; BEAST. Model testing, testing phylogenetic hypothesis - tree comparisons and statistical tests; Rates and Dates: Gene trees, species trees, calibrating the molecular clock, time dependency of evolutionary rates. Comparative Analyses, Different models of evolution, Phylogenetic analysis using nucleotide and protein sequence. Phylogenomics, co-phylogeny, TreeMap. Significance of phylogenetics,

Suggested Readings

Baxevanis, A.D. and Ouellette, B.F.F. (2001) Bioinformatics a practical guide to the analysis of genes and proteins A. John Wiley & Sons, Inc. Publications

Felsenstein, J. (2003) Inferring Phylogenies. Sinauer Associates. London

Hall, B (2007) Phylogenetic Trees Made Easy: A How-to Manual. Sinauer Associates, Inc., London ISBN: 0878933107

Hillis, D., Moritz, C. and Mable, (Eds.) (1996) Molecular Systematics, Academic Press, New York

Kitching, I., Forey, P. L., Humphries, C. J. & Williams, D. M. (1998) Cladistics: The Theory and Practice of Parsimony Analysis, 2nd ed. The Systematics Association Publication No. 11. Oxford University Press.

Lemey, P., Salemi M. and Vandamme, A.M. (2006) (eds.). The Phylogenetic Handbook. 2nd Edn. Cambridge University Press, UK. (final version 2006)

Nei, M. and Kumar, S. (2000) Molecular Evolution and Phylogenetics. Oxford Univ. Press.

Page, R.D.M. and Holmes, E.C. (1998) Molecular Evolution: A Phylogenetic Approach. Blackwell Science, New York.

Salemi, M. & A.-M. Vandamme, Eds. (2003) The Phylogenetic Handbook: A Practical Approach to DNA and Protein Phylogeny. Cambridge University Press.

Swofford, D. L., Olsen, G.J., Waddell, P. J. & Hillis, D.M. (1996) Phylogenetic inference. In Molecular Systematics, 2nd Ed. (D. M. Hillis, C. Moritz, & B. K. Mable, Eds.). Sinauer, Sunderland, Massachusetts.

Wiley E. O., Bruce S. Lieberman 2011. *Phylogenetics: Theory and Practice of Phylogenetic Systematics*, 2nd Edition, Wiley Blackwell publishers.

Primary Computer Programs

Maddison, W. P. & D. R. Maddison. 2000-2005. *MacClade: Analysis of phylogeny and character evolution*. Version 4.08. Sinauer Associates,

Sunderland, MA. or Maddison, W. P. & D. R. Maddison. *Mesquite* <http://mesquiteproject.org/>. Version 1.12.

Swofford, D. L. 2002. *PAUP*: Phylogenetic Analysis Using Parsimony (and Other Methods)*. Version 4.0b10. Sinauer Associates, Sunderland, MA.

Ronquist, F. & J. P. Huelsenbeck. 2003. MrBayes 3: Bayesian phylogenetic inference under mixed models. *Bioinformatics* 19: 1572-1574.

Drummond A.J. & Rambaut A. 2006. BEAST v1.4.5, available from <http://beast.bio.ed.ac.uk/>

Model question paper

**DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA**

First Semester

PG Diploma in Biodiversity Conservation Examination

BOT BC- E- 02. Phylogenetics

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. Name one distance method for inferring phylogeny
2. What is TreeView?
3. Define the term 'molecular clock'.
4. Name a search engine used to retrieve data from NCBI
5. What is Bremer support index
6. What is the purpose of Sequin at NCBI ?
7. Define the term 'database'.
8. Give the formula for calculating the standard error.
9. What are character states?
10. What is gene annotation?

(10X1= 10 marks)

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Highlight the difference between maximum likelihood and maximum parsimony?
12. Compare the pairwise and multiple alignments of nucleotide sequences.
13. What is the utility of a dendrogram in phylogeny?
14. What is the difference between UPGMA and WPGMA?
15. What is a phylogenetic tree? Identify the difference between Rooted and Unrooted trees
16. What is the relationship between gene and species trees?
17. Explain the different models of evolution.

(5X2= 10 marks)

III. Answer any *four* of the following. Each answer not exceeding 150 words

18. What are the different types of BLAST? Describe its applications
19. Explain the difference between structural and functional genomics.
20. Elaborate the resampling techniques such as bootstrapping and jackknifing
21. Elucidate the characteristic features of hypotheses testing
22. Write short notes on all the available nucleotide sequence databases.
23. What is the role of statistical tests in phylogeny?

(4X3= 12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. Discuss any four of the currently used sequence alignment tools.
25. Describe the significance of phylogenetics in biodiversity conservation

(1X8= 8 marks)

BOT BC- E- 03. Remote Sensing Applications

No. of Credits – 1

Unit 1. Introduction to Remote Sensing and Image Processing: Definition of remote sensing. Fundamental considerations: energy source (electromagnetic spectrum), wave length, interaction mechanisms, spectral response patterns, multi spectral remote sensing, hyper spectral remote sensing.

Sensor/ platform systems: ground based platforms, airborne platforms, space borne platforms. Satellite-based scanning systems. Indian Satellites. Fundamental sensor types: passive vs. active sensors, imaging vs. non imaging sensors. Fundamentals of digital image processing: image restoration, image enhancement, image classification, image transformation.

Unit 2. Remote Sensing Application to Forestry & Environment: Introduction, Loss of biological diversity, Biosphere reserves, The present issues on environment, Ecologically Hot Spot Areas, Marine environment, Wetland environment, Degradation of Ecosystems, Forestry-Forest cover mapping & Surveillance, Forest Type Mapping, Identification and Mapping of Major Forest Plantations, Forest Stock Mapping, Monitoring of Deforestation and Afforestation, Grassland Mapping,. Coastal vegetation, Wildlife habitat Assessment, Wastelands, Desertification, Use of space technology in Disaster Warning/Mitigation, Geosphere-Biosphere studies.

Suggested Readings

Avery, T.E. and Berlin, G.L. (2001) Fundamentals of Remote Sensing and Airphoto Interpretation, 6th Ed., MacMillan Publ. Co., pp 472.

Campbell, J.B. (2002) Introduction to Remote Sensing, 3rd Ed., 2002, The Guilford Press

<http://chesapeake.towson.edu/vermiz?principles.asp>

<http://rst.gsfc.nasa.gov>

<http://www.eduspace.esa.in.educ.com>

<http://www.star.nesdid.noaa.gov/smcd/opdb/tutorial/into.html>

<http://www.colorado.edu/geography/gcraft/notes>

Jensen, J.R. (1996) Introductory Digital Image Processing: A Remote Sensing Perspective, 2nd Ed., 1996, Prentice-Hall, New Delhi.

Jensen, J.R. (2000) Remote Sensing of the Environment, Prentice-Hall, New Delhi

Kramer, H. (2002) Observation of the Earth and its Environment: Survey of Missions and Sensors, 4th Ed., Springer-Verlag, Heidelberg

Kuehn, F. (Ed.) (2000) Introductory Remote Sensing Principles and Concepts, Routledge, pp215

Rao, D.P. (Ed.) (2002) Remote sensing for earth Resources Ass. Exploration Geophysicists, Hyderabad, India

Model question paper

**DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA
Second Semester**

PG Diploma in Biodiversity Conservation Examination

BOT BC- E- 03. Remote Sensing Applications

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. Define remote sensing
2. Which region of the EMR spectrum is absorbed by the chlorophyll in green vegetation?
3. What is signature?
4. Which is the major wavelength range used for remote sensing?
5. What is radiance?
6. Name one Indian satellite.
7. What is GIS?
8. What is a platform?
9. Name a biosphere reserve in India.
10. Expand SPOT.

(10X1= 10 marks)

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Write a short note on multi spectral remote sensing.
12. Explain briefly on non-imaging sensors.
13. What are different types of remote sensing based on function of sensors?
14. Differentiate between thermal infrared remote sensing (3 -100 μm) and visible and near infrared (0.4 – 2.5 μm) based remote sensing.
15. Give an account on ecological hotspot.
16. What is geometric restoration?
17. Distinguish between microwaves and UV waves.

(5X2= 10 marks)

III. Answer any *five* of the following. Each answer not exceeding 150 words

18. What are the platforms used for remote sensing? Explain.
19. Briefly explain geostationary orbit.
20. Comment on the present issues on environment.
21. How is passive remote sensing different from active remote sensing? Give example.
22. Describe the purpose of principle components analysis.
23. What are the different image enhancement techniques? Explain.

(4X3=12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. Explain how is remote sensing applicable in forestry?
25. Write a note on image transformation in digital image processing.

(1X8= 8 marks)

BOT BC- E- 04. Climate Change & Crop Adaptation

No of Credits - 1

Unit 1. Introduction to Global Warming and Climate Change: Greenhouse gases and alteration of climate. Indicators of climate change. Global warming in abiotic and biotic interactions. Effects of Global warming on aquatic and terrestrial ecosystem of India with particular reference to Western Ghats. Ecology and its Relevance to man, natural resources, their sustainable management and conservation. Physical and social environment as factors of crop distribution and production. Agro ecology; cropping pattern as indicators of environments. Environmental pollution and associated hazards to crops, animals and humans. Climate change – International conventions and global initiatives.

Unit 2. Impact of Climate Change in Agriculture- impact on soil-soil microbial activity, soil moisture availability and soil degradation. Impact of climate change on soil productivity-increase in temperature, increase in CO₂. Effects of extreme climatic events on yield crops. Impacts of climate change on insects and pests. Socio-economic aspects of climate change impacts. Crop Management design of simulate models- use of genetic engineering to develop stress resistant cultivar. Stimulation studies for determining the need for and profitability of irrigation. Crop ecosystem response to climate change: Rice, Coconut, Tapioca, Cashew, Pulses, Rubber, Spices, Tea & Coffee.

Suggested Readings

Agarwal, P.K and Mall, R.K. (2002) Climate change in rice yields in diverse agro environment of India Effects of uncertainties in scenarios and crop models on impact assessment. *Climate Change*: 52: 331-343

Anonymous (1999) Technology for pulse production in India. 220, IPR, Kanpur, pp108

Dhadke, K.G and Ghai, S (1994) Effect of global warming on insect populations and crop damage. *Shahpai*: 75-80

Gad, S. (1995) Climate change and agriculture. An Indian perspective. *Curr. Sci* 69

Gadgil, S., Rao, S.P.R and Sridhar, S (1999) Modeling impact of climate variability in rain fed ground nut. *Curr.Sci.*76: 557-569

Sukla, P.R. (2003) Climate change and India: Vulnerability assessment and adaptation. University press.

Model question paper

**DEPARTMENT OF BOTANY
UNIVERSITY OF KERALA**

Second Semester

**PG Diploma in Biodiversity Conservation Examination
BOT BC- E- 04. Climate Change & Crop Adaptation**

Time: Three hours

Maximum marks: 40

I. Answer all questions in one word or sentence

1. Define ecosystem.
2. What do we mean by climate?
3. What is greenhouse effect?
4. What is global warming?
5. What is aerosol?
6. How do clouds affect the Earth's climate?
7. What is agroecology?
8. What is biological pump?
9. Define electromagnetic spectrum.
10. Expand CFC

(10X1= 10 marks)

II. Answer any *five* questions. Each answers not exceeding 50 words.

11. Explain briefly the use of genetic engineering to develop stress resistant cultivar.
12. Write short note on greenhouse gases.
13. What are the main indicators of climate change?
14. Describe the effects of global warming in the aquatic ecosystem
15. What are the components in the climate system?
16. Write a note on biotic interaction of global warming.
17. How is climate change related to soil productivity?

(5X2= 10 marks)

III. Answer any *five* of the following. Each answer not exceeding 150 words

18. What are the remedial measures to reduce the harmful effects of climate change?
19. Briefly explain socio-economic aspects of climate change impacts.
20. Write a note on biotic interaction of global warming.
21. Explain the impact of climate change in crop ecosystem response.
22. How do humans have a major impact on the climate change?
23. What are the major effects of global warming? Explain.

(4X3=12 marks)

IV. Answer any *one* of the following, not exceeding 350 words

24. Write an essay on natural resources, their sustainable management and conservation?
25. Comment on environmental pollution and associated hazards to crops.

(1X8= 8 marks)