Post Graduate Diploma in Biodiversity Informatics

Syllabus 2017 - 2018 onwards

UGC Innovative Programme

Since 1951

CENTRE FOR BIODIVERSITY INFORMATICS
Department of Botany
Jamal Mohamed College (Autonomous)
College with Potential for Excellence
Re-Accredited (3rd Cycle) with 'A' Grade by NAAC
(A f f i l i a t e d t o B h a r a t h i d a s a n U n i v e r s i t y)
Tiruchirappalli – 620 020

Regulations and Syllabus

Course Description:

Biodiversity informatics is an emerging area with a perfect blend of modern and classical subjects like information technology, taxonomy, ecology and environmental biology with an innovative and new design curriculum to impart scientific base among students for globally needed important area of biodiversity conservation. This course aims to harness the power of information technology, network and software applications, bioinformatics, taxonomy, ecology and environmental biology to discover, develop and deliver human resources using novel technologies. This course is supported by University Grants Commission, New Delhi under Innovative Programme.

Name of course : Post Graduate Diploma in Biodiversity Informatics

Course duration : One Year Full Time Course (Two Semesters)

Eligibility : Post Graduate Degree in Life Science, Physical Science, Chemical and Earth Science, Computer Science, Humanities and Social Science with knowledge of Biology.

Admission for the programme will be based on the aggregated average of the performance of the candidate in PG examinations and also through the entrance examination conducted by the Department.

Medium of instruction : English

Intake capacity : 25 students

Programme Highlights:

- ☞ Course consists of instruction, assignment, six theory papers, four practical, an independent study paper and research project
- ☞ Course duration 12 months comprising two semesters
- ☞ Examinations at the end of every semester during November and April.
- ☞ Course is essentially field and computer laboratory based, interdisciplinary and applied in nature.
- ☞ Course deals with knowledge of biological data use in web accessible database for *in silico* biodiversity conservation purpose.
- ☞ Field visit and study is a unique opportunity for students to encounter a tropical flora & fauna and to get experience in a pragmatic way.

Regulations:

Scheme of Examination:

Examination will be conducted at the end of each semester. A candidate who fails in a course or courses can reappear for the same in the subsequent semesters. A candidate failing in the dissertation shall be required to resubmit his work in the next semester.

***Evaluation*:**

The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade points. Evaluation for each course shall be done by a continuous internal assessment by the concerned Course Teacher as well as by the semester end examination and will be consolidated at the end of the course. The components for continuous internal assessment for theory courses are:

Tests (Two)	:	20 Marks
Seminar (One)	:	10 Marks
Assignment (One)	:	10 Marks

Total	:	40 Marks

The evaluation of practical examination is also based on continuous internal assessment and on an end semester practical examination as 40 : 60.

Internal Assessment (20 marks):

Performance in Practical Class	:	05 marks
Submission of observation note books	:	05 marks
Lab course test (Two tests)	:	10 marks

External Examination (30 marks):

Practical Examination	:	20 marks
Submission of Record note book	:	05 marks
Viva Voce	:	05 marks

Passing minimum:

A candidate has to secure not less than 40 per cent of the marks in the Semester End Examination (SEE) and 50 per cent of the marks in the aggregate of the marks secured in the Continuous Internal Assessment (CIA) and the Semester End Examination (SEE) in each of the courses including practical. Out of 100 marks in each course, 40 per cent of marks are for Internal Assessment and 60 per cent for External Examinations.

Pattern of Question Paper:

The question paper in each of the course would comprise of Section A, Section B and Section C. In Section A, students have to answer 10 questions (10 × 1 = 10 marks). In Section B, there will be 5 questions in either… or pattern (5 × 4 = 20 marks). In Section C, three out of five questions have to be answered (3 × 10 = 30 marks).

Independent Study Course:

Students will have no written examination for the independent study course. They have to make a preliminary presentation of their chosen title before the faculty members and their classmates at the end of first month of the semester. This presentation will be evaluated by faculty members and all the students of the class and the marks secured will be considered for Continuous Internal Assessment I. A similar kind of presentation and evaluation will be made at the end of second month of the semester for Continuous Internal Assessment II. At the end of the semester, students will submit a hard and soft copy of their chosen title and make a presentation before the external examiner for their Semester End Examination. Out of 100 marks for the course, 40 per cent of marks are for Internal Assessment and 60 per cent for External Examinations.

Project Work:

Each candidate shall be required to take up a Project Work and submit report at the end of second semester. The Coordinator of the Programme shall assign the Guide who in turn will suggest the Project Work in consultation with the student in the beginning of the second semester. One typed copy of the Project Report shall be submitted to the Controller of Examinations through the Coordinator of the Innovative Programme on or before the date fixed by the Controller of Examinations of the College. The Dissertation will be evaluated by two External Examiners (one each of Life Sciences and Information Technology), appointed by the Controller of Examinations. The candidate concerned will have to defend his project in a Viva-Voce examination.

Dissertation :	80 marks [Two Interim Review Presentation (2 × 20)	: 40 marks
	Project Report Valuation by External Examiners	: 40 marks
Viva Voce		: 20 marks
Total		: 100 marks

A candidate shall be declared to have passed in the Project work if he/she gets not less than 40% in each of the Project Report and Viva/Voce but not less than 50% in the aggregate of both the marks for Project Report and Viva-Voce. A candidate who gets less than 40% in the Project Report must resubmit the Project Report. Such candidates need take again the Viva-Voce on the resubmitted project.

POST GRADUATE DIPLOMA IN BIODIVERSITY INFORMATICS

UGC Innovative Programme

COURSE STRUCTURE

(Applicable to the candidates admitted from the year 2017-2018 onwards)

Sem	Course Code	Course	Course Title	Hrs/ Week	Credit	Marks		
						CIA	ESE	Total
I	17PDBD1C1	Core I	Biodiversity Informatics for Conservation and Management	6	4	40	60	100
	17PDBD1C2	Core II	Biogeoinformatics	6	4	40	60	100
	17PDBD1C3	Core III	Python Programming	6	4	40	60	100
	17PDBD1C4	Core IV	DataBase Management Systems	6	4	40	60	100
	17PDBD1C5P1	Core V	Laboratory course for core I and II	3	2	20	30	50
	17PDBD1C5P2	Core V	Laboratory course for core III and IV	3	2	20	30	50
	Total			**30**	**20**	**200**	**300**	**500**
II	17PDBD2C6	Core VI	Data Integration for Biodiversity and Web Application Development	6	4	40	60	100
	17PDBD2C7	Core VII	Biostatistics	6	4	40	60	100
	17PDBD2C8	Core VIII	Independent Study Course	6	4	40	60	100
	17PDBD2C9P1	Core IX	Laboratory Course for core VI	3	2	20	30	50
	17PDBD2C9P2	Core IX	Laboratory Course for core VII	3	2	20	30	50
	17PDBD2PW	Project	Project	6	4	40	60	100
	Total			**30**	**20**	**200**	**300**	**500**
Grand Total				**60**	**40**	**400**	**600**	**1000**

SEMESTER I : CORE I

Biodiversity Informatics for Conservation and Management

Course Code:	17PDBD1C1	Max Marks:	100
Hours/Week:	6	Internal Marks:	40
Credits:	4	External Marks:	60

Objectives:

To enable students to understand the Key concepts of Evolution leading to speciation, Biodiversity and Conservation, Biodiversity informatics data requirements, Web resources, Biodiversity values and Protecting Biodiversity.

Unit 1: Evolution and Speciation: **18 Hrs**

Important events in Evolution. Evolutionary Mechanisms; Natural Selection, Artificial Selection, Adaptation, Co-evolution. Microevolution - Definition, Changes, Mechanisms. **Speciation**- Species, Causes, Reproductive isolation, Evidence of speciation, Co speciation. Macro evolution, its patterns. Diversity in Clades, Trends in evolution.

Unit 2: Biodiversity: **18 Hrs**

Definition, Plant, Animal and Microbial Diversity; Types – Genetic, Species and Ecosystem diversity; Benefits, Importance and Loss of Biodiversity; Centers of Diversity - Mega diversity Centers, Centers of Origin of Diversity, Hotspots. **Conservation Biology:** *In situ, ex situ* measures. Biotechnological tools for conservation. Organizations involved for conservation - CBD, IUCN, UNESCO, NBPGR, WWF, FAO, CITS, and TKDL.

Unit 3: Biodiversity Data Requirements: **18 Hrs**

Taxonomic and Historical Data – Museum and Herbarium, Molecular Data- Geonomics and Barcode Data. Spatial datasets. **Data Standards:** TDWG, SDD, DELTA, Darwin core, ABCD and Geodatabase Standards, biodiversity multimedia standards; Online tools for Standards - IPNI, Species 2000, Barcode Data Standards.

Unit 4: Web Resources for Biodiversity Informatics: 18 Hrs

GBIF, Catalogue of Life, OBIS, MANIS, Avibase, Fishbase,, Fishnet, COP, UNEP-WCMC, ITIS, IUCN, FAO, GLCF, IBIS, Vertnet, ATCC, PCC, NCBI Taxonomy, AVIS, Indian Biodiversity Portal, Western Ghats Biodiversity Portal, Biodiversity Information System **Bioinformatics databases:** Major Bioinformatic Resources **–** Genome, Sequence, Bibliographic, Protein Structure databases.

Unit 5: Biodiversity Economics and Legislation: 18 Hrs

Land Conversion, Invasions, Causes, Values and Policies for managing Agro-biodiversity. **Biodiversity legislation and Conventions –** International laws and Policies for biodiversity conservation, CBD conventions and targets, TRIPS, CITES, Ramsar, IITA and IATO, Environmental and Forest Acts. WTO, GATT, UPOV: Suigeneris System, Plant Breeders Rights, Patent offices in India, PPV and FRA.

Text Books (T.B.):

1. Krishnamurthy, KV., 2003, An advanced Text book on biodiversity, Oxford and IBH Book. Co., New Delhi
2. Hall, BK. and Hallgrimsson, B., 2014. Evolution, 5th Edition, Johnes and Bartlett India Pvt. Ltd. New Delhi.

Reference Books:

1. Ridley, M., Evolution, 3rd Edition, Blackwell Science Ltd a Blackwell Publishing company, USA, 2004.
2. Curry, G.B. and C.J. Humphries (ed), 2007. Biodiversity Databases Techniques, Politics, and Applications Edited by, CRC Press, Taylor & Francis Group. Frankel,
3. Otto, H., Anthony, H.D., Brown and Burdon JJ. 1995. The conservation of Plant Biodiversity, 1st edition, Cambridge University Press
4. Levin, SA (ed), Encyclopedia of Biodiversity Volume 1 – 5 . Academic Press
5. Manual of patent Practice and procedure Patent office, India, 2005.

Detailed Notes of Reference:

Unit 1: Evolution Understanding Evolution http:// evolution. berkeley.edu /evolibrary/ article/ evo_01 accessed on 28.12.2014.

Unit 1: Geologic Time and Earth's Biological History ftp://ftpdata.dnr.sc.gov /geology/Education/PDF /Geologic%20Time.pdf

Unit 2: Center of origin - Wikipedia, the free encyclopedia en.wikipedia.org/wiki/Center_of_origin accessed on 28.12.2014

Unit 2: Biodiversity Hotspots - http://en.wikipedia.org/wiki/Biodiversity_hotspot accessed on 28.12.2014.

Unit 2: General account on Biodiversity Krishnamurthy, K.V. An advanced Text on Biodiversity : Principles and Practice. Oxford & IBH publiching Co. Pvt. Ltd. New Delhi

Unit 2: Definition of Bidiversity: Biodiversity Notes : Definition ww.naturalresources.sa. gov.au accessed on 28.12.2014

Unit 2: Megadiverse Countries; http:// geography. about.com/od/ physicalgeography/a/Megadiverse - Countries.htm accessed on 28.12.2014

Unit 3: Geodatabase Standards: www.data. gov.bc.ca/local/dbc /docs/geo/services/ standards procedures/ file_geobase_standards.pdf accessed on 31.12.2014.

Unit 3: Geodata standards http://www.tdwg.org/proceedings/article/view/48 accessed on 31.12.2014

Unit 3: Barcode Standards : barcoding.si.edu/pdf/dwg_data_standards-final.pdf accessed on 31.12.2014.

Unit 3: UNESCO http://en.wikipedia.org/wiki/Biosphere_reserves_of_India accessed on 31.12.2014

Unit 4: Refer to specific Websites for every database

Unit 5: Environmental and Forest acts, TRIPS, UPCOV, Suigeneris systems, plant Breeders Rights, en.wikipedia.org accessed on 31.12.2014

Unit 5: Conservation, Management and use of Agrobiodiversity naasindia.org/Policy% 20Papers /pp4.pdf

Unit 5: PPV & FRA http://www.plantauthority.in/ accessed on 31.12.2014

Unit 5: Patent office of India http://www.ipindia.nic.in/ accessed on 31.12.2014

SEMSTER I : Core II

Biogeoinformatics

Course Code:	17PDBD1C2	Max Marks:	100
Hours/Week:	6	Internal Marks:	40
Credits:	4	External Marks:	60

Objectives:

To enable students to understand key concepts of Genomics, Genome annotation, Phylogeny and Geoinformation Technology.

Unit 1: Bioinformatics: 18 Hrs

Genomics: Definition of Genomics, Genome, Elements of genome organization, Genome sequencing; Genome maps: High and low-resolution map, Map elements, Polymorphic markers; Types of maps: Cytogenetic, Linkage, Transcript, Physical, Comparative, Integrated maps; Map repositories: NCBI – Entrez, Human genome map viewer, Practical uses of genome maps: Locating genomic regions, Target identification, Arrangement of genes and SNP diagnosis.

Unit 2: Genome Annotation: 18 Hrs

Structural annotation (Locating coding regions and structural elements of genes). Gene Prediction Approaches: ORF prediction, Gene prediction in and eukaryotes, Evaluation of gene prediction methods, Prediction of promoter sequences. Functional annotation: Prediction of gene function.

Unit 3: Phyloinformatics: 18 Hrs

Molecular evolutionary mechanisms, Terminologies used in Phyloinformatics. Criteria for Phylogenetic analysis -Morphology, Physiology, DNA, rRNA and Proteins. Problems in Phylogenetic analysis, Phylogenetic Trees – Definition and Types; Tree building methods – Sequence alignment, Determining the substitution model, Tree building and Tree evaluation. **Phylogeography** – Molecular markers, Genetic variation in space and time, Applied phylogeography.

Unit 4: Geo-information Technology: **18 Hrs**

Remote Sensing: Definition, Elements and Principles, Platforms and Sensors; Types – Optical, Microwave, Thermal, Multispectral and Hyper spectral. International and Indigenous satellite missions, Low and High Resolution

Satellites, Aerial photographs, Ortho images, Image Processing, Interpretation, Classification - Supervised, Unsupervised, Applications of Satellite Products for mapping, Monitoring Biodiversity.

Unit 5: GIS and GPS: **18 Hrs**

Basics of Geography, Map projections, Fundamentals of GIS, Map projections, Coordinate system, Spatial and non-spatial data types, Georeferencing, Digitization, Error handling, Thematic Map Generation, Visualization. GNSS – GPS, GLONASS/ Galileo - Principles of GPS, DGPS, Application of GPS. Open Source GIS data and Software (General account). Spatial analysis – Raster and Vector analysis. **Spatial modeling** – Biodiversity characterization, Gap analysis, Mapping deforestation, Forest fire risk analysis, Habitat suitability analysis, Setting conservation priority, Biomass and stack mapping. . **WebGIS concepts:** Geodatabase server architecture, Concepts of map scripts, open scripts, WMS, WFS.

Text Books:

T.B.1: Star J and Estes J, Geographic Information System- An Introduction. Prentice Hall Inc., New Jersey. 1990.

T.B.2: Lillesand, TM., Kiefer, RW. and Chipman, JW.. 6th edition. Remote Sensing and Image Interpretation , John Wiley & Sons Inc., New Delhi2008

T.B.3: Higgs PG. and Attwood TK,. Bioinformatics and Molecular Evolution, Blackwell publishing, USA. 2005.

Books for Reference:

1) Trevor B.E.E and Rower G, 2nd edition, An Introduction to Molecular Ecology. Oxford University Press, UK. 2008

2) Roderic DM, Holmes, Edward C. 1998. Molecular Evolution: A Phylogenetic Approach Blackwell Publishing Ltd, USA.

Detailed Notes of Reference:

Genomics and Genomic Annotation :

a. Andreas D.Baxevanis and B.F.Francis Ouellette 2001 Bioinformatics – A practical Guide to the analysis of Genes and Proteins By ,2nd edition, A John Wiley & sons, Inc, Publications.

b. David W. Mout, Bioinformatics Sequence and Genome Analysis . Cold Spring Harbor Laboratory Press.

c. Primrose S.B and R.M.Twyman. Principles of Genome analysis and Genomic. 2003 3rd Edition. Blackwell publishing Company.

d. Primrose S.B and R.M.Twyman. Principles of Gene Manipulation and Genomics. 7th Edition, 2006. Blackwell publishing.

e. Higgs PG and Attwood TK. Bioinformatics and Molecular Evoltution. 2005. Blackwell Publishing USA.

Phyloinformatics :

a. Ropderic DM,Holmes, Edward C. 1998 Molecular Evolution : A Phylogenetic Approach Blackwell publishing. Ltd. Trevor BEE, Rower G. An Introduction to Molecular Ecology. 2008 Oxford Unversity Press, UK.

Remote Sensing

a. Anji Reddy , M. 2000. Remote Sensing and Geographical Information System. JNTU, Hyderabad.

b. Star J and Estes J.1990 . Geographic Information System – An Introduction Prentice Hall Inc. New Jerysey.

c. Image Classification : http://www.sc.chula.ac.th/courseware/2309507/Lecture/remote18.htm (accessed on 12/1/2015)

d. GPS/GNSS general account : https://www.princeton.edu/~alaink/Orf467F07/GNSS.pdf (accessed on 12/1/2015)

e. Spatial analysis http://www.iasri.res.in/ebook/GIS_TA/M3_3_SDAofV&RD.pdf (accessed on 12/1/2015)

f. Spatial Modelling http://www.academia.edu/5407689/The_Review_of_Biodiversity_and_Conservation_Study_in_India_Using_Geospatial_Technology (accessed on 12/1/2015)

g. http://en.wikipedia.org/wiki/GeoServer (accessed on 12/1/2015)

h. Map script General definition : http://www.invet.net/images/catalog/creating_maps.pdf

i. http://en.wikipedia.org/wiki/Web_Feature_Service/ Web_Map_Service/(accessed on 12/1/2015)

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SEMESTER I: CORE III

Python Programming

Course Code:	17PDBD1C3	Max Marks:	100
Hours/Week:	6	Internal Marks:	40
Credits:	4	External Marks:	60

Objectives:

To enable students to understand python programming language for analyzing biological and geospatial data

Unit 1: Python : **18 Hrs**

Introduction - Data Structures - Installation - Python Interpreter, Usage and customization - Editor setup – Variables - Expressions and Statements – Operators- Control structures – Looping structures.

Unit 2: OOPS in Python: **18 Hrs**

Classes – Scopes and Namespaces – Class Objects – Instance Objects – Method Objects – Inheritance – Iterators – Generators – Generator Expressions. Functions - Strings – Lists – List Comprehensions – Stacks – Queues – Tuples – Sequences – Sets – Dictionaries – Sets.

Unit 3: **Modules, I/O and Exception Handling:** **18 Hrs**

Modules – Search path – Compiled modules – Standard modules – Packages – Input and Output functions– Files – Read and write – Exception – Handling and Raising – User defined Exceptions.

Unit 4: Python Standard Library: **18 Hrs**

OS Interface – Command line arguments –String Pattern Matching – Mathematics – Internet Access – Dates and Times

Unit 5: Data Compression: **18 Hrs**

Performance Measurement – Quality Control – Templating – Multi-threading – Logging. Python tools for GIS development, Python libraries in GIS. General account on Python for web development.

Text Books:

T.B.1: Jones, M. 2013, Python for Biologists, http://pythonforbiologists.com

T.B.2: Payne, J. Beginning Python Using Python 2.6 and Python 3.1 www.wrox.com

Books for Reference

1) Lutz M., 2009, Python Pocket Reference, O'Reilly Media, Inc., CA.
2) Briggs, J.R., 2013, Python for Kids A Playful Introduction to Programming , William Pollock, CA.

Detailed Notes of Reference:

Unit 1 to 5 :

a. Python Programming - Guido van Rossum Fred L. Drake , Python Tutorial Release 3.2. 3.

b. Python Software Foundation Page 1 to 88.

Core Course IV: DataBase Management Systems

Course Code:	17PDBD1C4	Max Marks:	100
Hours/Week:	6	Internal Marks:	40
Credits:	4	External Marks:	60

Objectives:

To enable the students to understand Database concepts as well as designing and developing of an RDBMS database.

Unit 1: Database system concept: 18 Hrs

Characteristics of data in a database – Functions of DBMS – File Based Data Management - Disadvantages of file system –- Components of a database - Comparison between Database and file-processing systems – Data dictionary – Data abstraction - Data independence. **Architecture:** Overall Architecture of DBMS, Three level architecture. **Data Models:** Hierarchical, Networking, Relational Data Models – E-R Model – E-R Diagrams - EER Model.

Unit 2: Relational Data Model: 18 Hrs

Characteristics – CODD's rules - Relational Structure **-** Tables (Relations), Rows (Tuples), Domains, Attributes, Extension, Intention. **Keys:** Candidate Key, Primary Key, Foreign Key, Super Keys, Unique Keys. **Data Constraints:** Primary key constraint, Unique, Check constraint, strong Entity, Weak Entity. **Normalization:** Introduction – Purpose of Normalization – Definition of Functional Dependence (FD) Relational database Design, - Normal forms: 1NF, 2NF, 3NF, BCNF.

Unit 3: Interactive SQL: 18 Hrs

Introduction to SQL **-**Advantages of SQL - Invoking SQL*PLUS, The Oracle Data-types, Data Definition Language (DDL), Data Manipulation language (DML), Data control language (DCL), Data Query Language (DQL) and related commands.

Queries using Group by and Order by clause & Join: Querying a Single Table, Ordering Results, Grouping the results, Joins, Types of Joins, Sub queries. **Operators:** Arithmetic, Comparison, Logical Operators, Set operators. **Build in Functions:** Character, Arithmetic, Date and time, Group and Miscellaneous functions, Commit, Rollback, Save Point. **Format models:** Character, Numeric & Date format models.

Unit 4: SQL View & PL/SQL: 18 Hrs

Views: Introduction – Advantages of views - The Create View Command, Updating Views, Views and Joins, Views and Sub queries - Dropping Views.

Indexes: Index Types, Creating of an Index: Simple Unique and Composite Index, Dropping Indexes. **Introduction to PL/SQL:** The PL/SQL Syntax, The PL/SQL Block Structure, Fundamentals of PL/SQL, Advantages of PL/SQL data Types. **Control Structure:** Conditional Control, Iterative Control, Sequential Control.

Unit 5: Exception Handling, Cursors: 18 Hrs

Exception handling - Predefined Exception - User defined Exception. **Cursors:** Declaring - Opening and Closing a Cursor - Fetching a Record from Cursor **Procedures:** Advantages - Creating - Executing and Deleting a Stored Procedure. **Functions:** Advantages – Creating - Executing and Deleting a Function.

Text Books:

T.B.1: Leon, A. and Leon, M., 1st ed., Essentials of Data Base Management System. TMH, New Delhi and Vijay Nicole Imprints Private Limited, Chennai, 2009.

T.B.2: Pannerselvam, R., 2nd ed. Database Management Systems, PHI Learning Pvt Ltd, New Delhi, 2011.

T.B.3: Amon a. Mato- Toledo, Cushman, PK. Database Management Systems , 2nd Edition (India), , Schaums' Outline series, TMH, New Delhi, 2007.

Books for Reference

1) Maheswari, S. and Jain, R., 1st ed., SQL and PL/SQL, Firewall Media New Delhi,2010.
2) handare, S., 2010, 2nd ed. Database Management and Oracle Programming, S. Chand and Co, New Delhi, 2010.
3) Schatz, A. S and Korth, H., 6th ed. Database System Concepts, McGraw Hill , New Delhi, 2005.
4) Data Base Management System ISRD Group , 1st ed., TMH, New Delhi, 2011.

Detailed Notes of Reference :

a. Database Management System -Unit-1 to 5 Edvin Dayanand and R.K.Selva Kumar. Relational Database Management, NV publications, Pollachi
b. Maheswari, S. and Jain, R., 1st ed., SQL and PL/SQL, Firewall Media New Delhi,2010.
c. Handare, S., 2010, 2nd ed. Database Management and Oracle Programming, S. Chand and Co, New Delhi, 2010.

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SEMESTER I : CORE V

Laboratory course I for core I and II

Course Code:	17PDBD1C5P1	Max Marks:	50
Hours/Week:	3	Internal Marks:	20
Credits:	2	External Marks:	30

Objectives:

Students to get practical exposure in field data collection, software used in Bioinformatics, Geoinformatics and Spatial modeling.

Biodiversity

1. Diversity Measurements – Shannon-Weiner, Simpson, Jaccard
2. Constructing phylogenetic tree using Phenetic/Morphological data
3. Demarcating the species of your region using Venn diagram
4. Identifying the species name for TDWG using ITIS
5. Identifying various web resources for Biodiversity informatics

Bioinformatics:

1. Sequence databases, nucleic acid sequence database - NCBI, EMBL, DDBJ
2. Data base file formats - NCBI, EMBL and DDBJ
3. Gene structure and function prediction - GENE SCAN
4. Sequence similarity searching - NCBI BLAST
5. Molecular phylogeny – PHYLIP

Remote Sensing & Geoinformatics

1. Geo-rectification images
2. Onscreen Visual Interpretation
3. Thematic Data Generation – Road network, Drainage, Soil, Rainfall,
4. GPS data collection
5. Species Distribution map generation using Latitude and Longitude values
6. Overlay analysis, Ranking/Weighting methods
7. Spatial Models – Habitat Suitability Model, Conservation Priority Setting

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SEMESTER I : CORE V

Laboratory course II for core III and IV

Course Code:	17PDBD1C5P2	Max Marks:	100
Hours/Week:	3	Internal Marks:	20
Credits:	2	External Marks:	30

Objectives:

Students to get practical exposure to Python programming and its application in Biological sciences, and get knowledge on Database Development using PLSQL.

Python Programming

1. Program using arithmetic operators
2. Program using logical operator
3. Storing strings in variables and Print (Example using Sequence Data)
4. Concatenation of two strings and Print (Example using Genus and Species Name)
5. Calculating AT content
6. Identify Complementing DNA
7. Cleaning Data and Graphing in Python
8. Arrange the given strings in alphabetical order
9. Using List concept using Python Programming

DBMS

1. Installation and Configuration of WAMP server.
2. a. Creation of New Table with minimum five fields with different data types.
   b. Inserting values to the New Table with INSERT Command. (Minimum 5 records).
   c. Use of ALTER TABLE COMMANDS in Existing Tables.
3. a. Use of UPDATE Commands in Existing Tables.
   b. Use of DROP, TRUNCATE, DELETE, TRUNCATE Commands.
   c. Creating VIEW for existing tables.
4. a. Use of SELECT with Where Clause.
   b. Use of BETWEEN Clause in Where Condition.
5. a. Use of SET operation in tables.
   b. Use of Sub Query in Tables.
   c. Use of Logical Operation in SELECT Clause.
6. PL/SQL Program using Exception Handling.
7. PL/SQL Program using function and procedures.
8. PL/SQL Program using Cursors.
9. Creating Simple website with Texts and an Image using HTML
10. Creating a Web page with Lists, Check Box, Radio Button using HTML.

SEMESTER II : CORE VI

Data Integration for Biodiversity and Web Application Development

Course Code:	17PDBD2C6	Max Marks:	100
Hours/Week:	6	Internal Marks:	40
Credits:	4	External Marks:	60

Objectives:

To enable students to develop or enhance skills in analyzing, synthesizing and integrating biodiversity related information and create effective web applications**.**

Unit 1: Data Warehousing: 18 Hrs

Introduction, Importance, Guidelines**,** Data warehousing concepts, Architecture, implementation. **Data Mining:** Fundamentals, Functionalities, Major issues, Data Preprocessing. Mining Sequence patterns in Biological Data, Mining Object, Spatial, Multimedia, Text and Web data.

Unit 2: Web development: 18 Hrs

General account on Python for web development. **HTML :** Introduction - Tags of HTML - Text formatting - Working with Images - Meta tag - HTML tables - HTML Frames - Forms-Form and INPUT Tag - Text Box, Check box, Radio Button tags. Introduction to XML, Applications, the power of Python and XML, Converting XML to HTML.

Unit 3: Java Script: **18 Hrs**

Introduction, Program structures, Execution procedure, Data types, Variables, Strings, Operators, If-else structure, Else-if, Switch-case structure, Looping structures, Built-in functions, Form Handling and validation, Dialog Box, Alert boxes and Prompt Boxes.

Unit 4: PHP: 18 Hrs

Introduction, PHP program structures, Execution procedure, Data types, Variables, Strings, String functions, Operators, If-else structure, Else-if, Switch-case structure, Looping structures, PHP functions, Form handling and validation, Data base Connection using MySql, Retrieving data from data base and displaying in the web site.

Unit 5: Cloud, Grid and Mobile Computing: 18 Hrs

Definition, private, public and hybrid cloud. Cloud types: IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, Next generation Cloud Applications. **GIS cloud applications** - Visualization, Analysis and exploration of geographic information. Application of Grid and Mobile Computing in Biodiversity Informatics.

Text Books:

T.B.1: Micheline Kamber, J.H., 2nd ed., Data, Mining: Concepts and Techniques Elsevier Inc, San Francisco, CA,2006.

T.B.2: GIS Cloud User Manual- Step by Step application of GIS cloud application. www.giscloud.com

T.B.3: Text Book : Ivan Bayross, 2nd ed., Web Enabled Commercial Application Development Using HTML,DHTML,JAVASCRIPT AND PERL CGI, BPB Publication, Delhi,2000.

Books for Reference

1) Abdelkader Hameurlain Wenny Rahayu David Taniar (eds.) Data Management in Cloud, Grid and P2P Systems 6th International Conference, Globe 2013 Prague, , August Proceedings, Springer publications. Czech Republic. 2013.
2) Steve Suehring, 2nd ed., JavaScript Step by Step, O'Reilly Media, Inc. California, 2010.
3) Timothy Boronczyk, Elizabeth Naramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass. Beginning PHP6, Apache, MySQL. Web Development , www. wrox.com
4) iCloud for Developers Automatically Sync Your iOS Data, Everywhere, All the Time Cesare Rocchi, The Pragmatic Programmers, LLC, USA. 2013.

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Detailed Notes of Reference

Unit-1

a. Micheline Kamber JH, 2006 2nd Edition, Data, Mining: Concepts and Techniques Elsevier Inc, San Francisco, CA.

Unit-2 to 4

a. Ivon Bayross,2nd ed, Web Enabled Commercial Application Development Using HTML,DHTML,JAVA SCRIPT AND PERL,CGI – BPB PUBLICATION,DELHI-2000.

b. Ivan Bayross, 2nd ed., Web Enabled Commercial Application Development Using HTML, DHTML, JAVASCRIPT AND PERL CGI, BPB Publication, Delhi,2000.

Unit-5

a. GIS Cloud User Manual- Step by Step application of GIS cloud application. www.giscloud.com

SEMESTER II : CORE VII

Biostatistics

Course Code:	17PDBD2C7	Max Marks:	100
Hours/Week:	6	Internal Marks:	40
Credits:	4	External Marks:	60

Objectives:

To enable the students to understand and apply statistical methods that are necessary to process and interpret biological data and to develop skill in using statistical software like R.

Unit 1: Statistical concepts: **18 Hrs**

Data vs Information, Importance of Statistics in Biodiversity, **Level of Measurements** - Nominal/categorical, Ordinal, Interval, Ratio. **Variables –** Dependent variable, Independent variable. Sampling methods, Probability distribution. **Tests for nominal variables**: Binomial test, Chi-square test, G-test, Fisher's exact test, Cochran-Mantel-Haenszel test.

Unit 2: Measurement of Variables: **18 Hrs**

One way, Two way Annova, Student t-test, Paired t-test, Wilcoxon Signed Rank test, Sign test. Multiple measurement – Linear Regression and Non Linear Regression, Sperman rank correlation, Polynomial regression, Multiple and logistic regression.

Unit 3: Software for Biological data Analysis: **18 Hrs**

General account on MS-Excel, Minitab, SPSS, Origin, R, SAS, PAST, Biodiversity Professional, Estimate S, MATLAB. **R:** Introduction, Basic Statistical and Mathematical functions, Types of objects, Classes, Creating and accessing objects, Matrics, Data Frames. Loading, Examining and manipulating a data set.

Unit 4: Data Management : **18 Hrs**

Importing, Sub setting, Merging, Missing Data Plotting- Box plot, Loops and Functions, Analysis of gene expression and genomics data. **Spatial Statistics:** Calculating Landscape Metrics, GLM, ggplot, Model-based graphing, Spatial prediction Models.

Unit 5: Modeling: **18 Hrs**

Introduction to modeling, Univariate and Bivariate modelling. **Multivariate modeling**: Principle Component Analysis, Conical Correspondence Analysis. **Modeling in Ecology** - Introduction, Simple models of temporal change (General account), Modeling structured populations, Spatial models.

Text Books:

T.B.1: Mcdonald, J.H. . Hand Book of Biological Statistics , Sparky House Publishing, Mary land. 2008

T.B.2: Bailey,N.T.J. Statistical methods in Biology, 3rd ed.,Cambridge University Press, Cambridge,1995.

T.B.3: Khan, I.A. and Khanum, A fundamental of Biostatistics, Vikas Publications, Hyderabad, 1994.

Books for Reference

1. Gillman, M. An Introduction to Mathematical Models in Ecology and Evolution Time and Space, Blackwell Publishing, UK. 2009
2. Verzani, J. Getting Started with R Studio., Published by O'Reilly Media, Inc., USA. 2009.
3. Nivedita Majumdar and Swapnonil Banerjee, MATLAB Graphics and Data Visualization Cookbook, Packt Publishing, 2012.

Detailed Notes of Reference

Statistical concepts & Measurement of Variables:

a. Mcdonald, J.H. . Hand Book of Biological Statistics , Sparky House Publishing, Mary land. 2008

b. Bailey,N.T.J. Statistical methods in Biology, 3rd ed.,Cambridge University Press, Cambridge,1995.

c. Khan, I.A. and Khanum, A fundamental of Biostatistics, Vikas Publications, Hyderabad, 1994.

R statistics, Data Management – Spatial Statistics

a. http://cran.r-project.org/doc/manuals/r-release/R-intro.html Accessed on 12.1.2015

Modelling

a. Gillman, M. An Introduction to Mathematical Models in Ecology and Evolution Time and Space, Blackwell Publishing, UK. 2009

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SEMESTER II : CORE VIII

Independent Study Paper

Course Code:	17PDBD2C8	Max Marks:	100
Hours/Week:	6	Internal Marks:	40
Credits:	4	External Marks:	60

Objectives:

To enable the students to remediate deficient areas of knowledge, behavior or skills in Biodiversity Informatics.

Course Requirements

- Students discuss their topic with a faculty member with whom they would like to complete the independent study course and solicit the faculty member's commitment to being the course supervisor.
- Once the faculty supervisor is identified, the student and faculty supervisor determine the specific title in which the student will be involved.
- After this discussion, the student presents a typed outline of the independent study paper to the faculty supervisor to get his approval. The outline must consist of the following elements;
  - Purpose and objectives of the independent study
  - A short description of the paper of study, including a title
  - A list or description of the components of the project to be completed by the student
  - A timeline for completion of the project within one semester.
  - A list of the number and approximate dates for meetings between the faculty and student for evaluation and discussion.

SEMESTER II : CORE IX

Laboratory course I for core VI

Course Code:	17PDBD2C9P1	Max Marks:	50
Hours/Week:	3	Internal Marks:	20
Credits:	2	External Marks:	30

Objectives:

To enable students to get expos ed in Data mining software, Geodatabase creation for web domain, Web application development using PHP, Java script and Open Source Technologies like Django and Web GIS

Data mining

1. Application in Biological Sciences
2. WEKA software applications in Data mining

Geo Database Creation and Web GIS

1. Creation of Spatial Database
2. Import the GIS database
3. Connect the Geo Data into Server.
4. Symbolize the thematic layer.

Web Development

1. Creating Simple website with Texts and an Image using HTML
2. Creating a Web page with Lists, Check Box, Radio Button using HTML.
3. Creating A Web page with Lists, Check Box, Radio Button using PHP
4. Simple Form Creation using PHP.
5. Program for Connecting MySql Data Base with PHP and Display the table values.
6. Program for inserting values to MySql tables thru PHP.
7. Creating web page using Java Script.
8. Web Development using Django.

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SEMESTER II : CORE IX

Laboratory course II for core VII

Course Code:	17PDBD2C9P2	Max Marks:	50
Hours/Week:	3	Internal Marks:	20
Credits:	2	External Marks:	30

Objectives:

To enable students to get exposed to application of various statistical techniques for assessment of biodiversity samples and apply R language for biodiversity measurement

Test Statistics

1. The significance of behavior of birds in a forest using G test
2. Cochran–Mantel–Haenszel test for wildlife underpasses on a highway
3. Student's t-test to compare tree girth in healthy and disturbed forest ecosystem
4. Nest Annova to assess the habitat of lichens
5. Correlation and liner regression in species diversity estimates
6. Spearman rank correlation in Pouching size and sound in birds.

R statistics for Assessment of Biodiversity data

1. Diversity indices
2. Rarefaction
3. Taxonomic and functional diversity
4. Multivariate Analysis of Ecological Communities in R
5. Importing species occurrence data
6. Data cleaning ,Duplicating, Cross checking
7. Extracting Raster layers
8. Model fitting , prediction and Evaluation
9. Models in R – Geographic Models, Regression Model, Combining Model Prediction

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SEMESTER II : PROJECT

Project Work

Course Code:	17PDBD2PW	Max Marks:	100
Hours/Week:	6	Internal Marks:	40
Credits:	4	External Marks:	60

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