VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Integrated Biotechnology
Syllabus: Semester -IX
IBT – 901: Biodiversity and Bioresources

SECTION-1

Unit-1: Plant Diversity:

1.1 Components of biodiversity. Biodiversity of lower group of plants- Bryophytes, Pteridophytes and Lichens.
1.2 Nature and origin of plant genetic variation. Genetic diversity in plants.
1.3 Diversity of 2^0 metabolites in plants. Determining chemotaxonomy of plants.
1.4 Agro biodiversity and cultivated taxa. Centers of origin of cultivated plants. Wild varieties of cultivated crop plants.
1.5 Study of rare and endangered species of plants with reference to IUCN threat categories. Current trends-Molecular taxonomy and phylogenetic studies.

Unit-2: Animal Diversity:

2.1 Molecular taxonomy and genetic diversity.
2.2 Species and population diversity- Meta-population concept.
2.3 Centers of origin of domesticated Animals.
2.4 Diversity of metabolites among marine invertebrate fauna.
2.5 Study of rare and endangered animals (case studies):
- Project Tiger.
- Project Crocodile.
- Green Sea and olive Reedley turtles.
- Dolphin.

SECTION-2

Unit-3: Microbial diversity:

3.1 Microbial diversity- A changing paradigm.
3.2 Types of diversity:
3.2.1 Metabolic diversity.
3.2.2 Phylogenetic diversity.
3.2.3 Diversity of terrestrial and aquatic ecosystem.
3.3 Applications of Microbial diversity:
3.3.1 Use in Biogeochemical cycles.
3.3.2 Use in Bioremediation.
3.3.3 Use in Biotechnology industries.
3.4 Microbial diversity and global environmental issues.

Unit –4:

4.1 Cellular and molecular aspects of Biodiversity:

- 4.1.1 Diversity of photosynthetic prokaryotes.
- 4.1.2 Diversity in rRNA sequence.
- 4.1.3 Diversity of microbial heterotrophic metabolism.
- 4.1.4. Genetic diversity: Polymorphism, repetitive DNA, Tandem repeats, Interspersed repeats, SNPs etc.
- 4.1.5 Characterization of DNA polymorphism – Single locus approach, Multi locus approach.
- 4.1.6 PCR base and Non PCR based methods of monitoring Diversity.

References:

1. Samit Ray and Arun K. Ray, Biodiversity and Biotechnology, New Central Book Agency (P) Ltd. (2007)
2. Pushpangadan P., Ravi K and V. Santhosh, Conservation and Economic evaluation of Biodiversity Vol.I & II (1997)
3. Wealth of India CSIR, New Delhi.
4. An advanced text book of biodiversity. Principles and practice. By K. V. Krishnamurthy. Oxford and IBH company Pvt Ltd.
5. Biodiversity conservation: A Genetic Approach by S. Biswas. Oxford Book Company. 2007.
6. Biodiversity endangered: India's threatened Wildlife and Medicinal Plants. By A. B. Chaudhari and D. D. Sarkar. Scientific publishers. Jodhpur.
7. Animal Biodiversity: Patterns and processes. T. N. Ananthakrishnan and K. G. Sivaramakrishnan. Scientific publishers. Jodhpur.
8. Biodiersity and Natural products diversity by Franceso pietra. Elsevier. 2002.
9. Microbial Diversity by O. Ogunseitan. Blackwell publishing.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Integrated Biotechnology
Syllabus: Semester -IX
IBT – 902: Instrumentation and Techniques

SECTION-1

Unit-1: (10 hrs)

- **Centrifugation:**
  - Basic principles of sedimentation.
  - Types of centrifuges.
  - Types of rotors.
  - Separation methods in preparative ultracentrifuges:
    - Differential centrifugation.
    - Density gradient centrifugation.
    - Analysis of sub cellular fractions.
  - Applications of Analytical ultracentrifuge:
    - Determination of relative molecular mass.
    - Estimation of purity of macromolecules.
    - Conformational changes in macromolecules.
  - Safety aspects in use of centrifuge.

Unit-2: (10 hrs)

- **Spectrophotometry:**
  - Molecular Absorption Spectroscopy:
    - Laws of photometry.
    - Instrument components- single beam and double beam.
    - Quantitative analysis.
    - Principles and application of IR spectroscopy.
    - Principles and application of NMR and Mass spectrometry.
  - Atomic spectrometry (working principle and applications):
    - Flame Emission Spectrometry.
    - Atomic Absorption Spectrometry

SECTION-2

Unit-3: (10 hrs)

- **Electrophoretic Techniques:**
  - Principles of electrophoresis.
  - Support media.
  - Electrophoresis of proteins:
    - SDS PAGE
    - Native gels
    - Gradient gels
    - Isoelectric focusing
    - Two dimensional electrophoresis
    - Western blotting

- Electrophoresis of Nucleic acids:
  - Agarose gel of DNA and RNA.
  - DNA sequencing gels.
  - Southern blotting.

Unit-4: (10 hrs)

- **Chromatographic techniques:**
  - Classification of chromatographic techniques.
  - Principles of chromatography.
  - Support media and solvent systems for chromatography (TLC and HPTLC).
  - Methods of development -spot detection.
  - Principles of GC separation, stationary and mobile phases.
  - GC-MS combination applications.
  - Liquid Chromatography.
  - Column Chromatography.
  - Ion Exchange Chromatography.
  - HPLC: Layout of instrument, pumps, degassers, guard column, stationary and mobile phases, detectors-UV absorption, RI and fluorescence, Isocratic and gradient elution.

- **Radio isotopes techniques:**
  - Detection & measurement of radio activity.
  - Geiger-Muller Counter.
  - Scintillation Counter.
  - Autoradiography.

References:

1. Keith Wilson & John Walker (Ed.) (2000): Practical Biochemistry - Principles & Techniques. Cambridge University Press.
2. Keith Wilson and John Walker (Ed). (2006) Principles and techniques of Biochemistry and Molecular Biology. Cambridge University Press.
3. James S. Fritz & George H. Schenk, Jr. (1969): Quantitative Analytical Chemistry (2^{nd} edition). Allyn & Bacon, Inc., Boston.
4. Brown S.B. (1980): An Introduction to Spectroscopy for biochemists. Academic Press London.
5. Andrews A.T. (1986): Electrophoresis: Theory, Techniques and Biochemical and Clinical Application. Oxford University Press.
6. Hawcroft D.M. (1996): Electrophoresis - The Basics. IRL Press, Oxford.
7. Robards K., Haddad P.R., & Jackson P.E. (1994): Principles and Practice of Modern Chromatographic Methods. Academic Press, London.
8. E.D.P. De. Robertis & E.M.F. De Robertis Jr. (2001) : Cell and Molecular Biology (8^{th} edn.) Lippincott Williams & Wilkins, London.
9. Skoogs, Holler and Nieman, (2006) Principles of Instrumental Analysis, Thomson books.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Integrated Biotechnology
Syllabus: Semester -IX
IBT – 903: Advances in Molecular Biology

SECTION-1

UNIT-1: Model Organisms for Genetics:
Escherichia coli, Saccharomyces cerevisiae, Neurospora crassa, Arabidopsis thaliana and *Caenorhabditis elegans.*

UNIT-2: Whole Genome Analyses:
Preparation of ordered cosmid libraries.
Bacterial artificial chromosomal libraries.
Shotgun libraries.
Sequencing:
Conventional sequencing (Sanger, Maxam and Gilbert methods).
Automated sequencing.
DNA and RNA editing.

SECTION-2

UNIT-3: Plasmid Biology and Transposons:
Plasmid Biology and Insertion sequences.
Bacterial Transposons; Simple and Complex.
Mechanisms of Transposition.

UNIT-4: RNAs in Gene Regulation:
Double stranded RNA.
siRNA.
miRNA.
Their role in gene regulation and development.

References:

1. The internet and New Biology: Tools by Genomic and Molecular Research by Peruski, Jr. and Peruski (ASM) 1997.
2. Functional Genomics: A Practical Approach, Stephen P. Hunt and Rick Livesey, Eds., Oxford University Press 2000.
3. DNA Microarrays: a Practical Approach, Mark Schlena, ed., Oxford University Press.
4. Introduction to genetic analysis, Griffiths, Wessler, Lewontin, Gelbart, Suzuki and Miller, Eighth edition, Freeman and Company.
5. Genomes, T. A. Brown, John Wiley and Sons PTE Ltd.
6. Gene VIII by B. Lewin.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Integrated Biotechnology

Syllabus: Semester -IX

IBT – 904: Bioethics, Biosafety, IPR and Entrepreneurship Development

SECTION-1

Unit-1:

Bioethics:

- Introduction to Bioethics and Biosaftey.
- Human genome project and its ethical issues.
- Ethical issues in Genetically modified food and crops.
- Ethical issues involved in stem cell research.
- Ethical issues of organ transplantation.
- ICMR Ethical Guidelines for Biomedical Research on Human Subjects.
- Good clinical practice for clinical research.

Biosafety:

- Introduction and history.
- Biosftey guidelines and regulations.
- Risk assesment, regulation and containment.
- Potential effect on Environment and Human health by transgenic plants.

Unit-2:

Biopiracy :

- Biopiracy and traditional knowledge.
- Case studies of biopiracy :
    - RiceTec Patent No. 5663484 in the USPTO.
    - Monsanto's biopiracy of Indian wheat.
    - Neem.
    - Curcuma.

Intellectual Property Rights:

- Introduction and history.
- Protection of intellectual property rights.
- Patent laws and procedure of patenting.
- Limits of a patent.
- Plant variety protection.

SECTION-2

Unit-3:

Entrepreneurship-I:

- **Introduction:** Concept and theories of Entrepreneurship, Entrepreneurial traits and motivation, Nature and importance of Entrepreneurs.
- **Project management**: Search for a business idea, concept of project and classification, project identification, project formulation, project design and network analysis, project report, project appraisal.
- **Financial analysis:** Ratio analysis, Investment process, Break even analysis, Profitability analysis, Budget and planning process.

Unit-4:

Entrepreneurship-II:

- **Sources of finance:** Source of development finance, Project financing, Institutional financing to Entrepreneurs, Financial institutions, Role of consultancy organizations.
- **Marketing channels:** Methods of marketing, marketing channels, Marketing institutions and assistance.
- **Setting up a small scale industry:** Location of an enterprise, steps for starting a small industry, incentives and subsidies, exploring export possibilities.

References:

1. Bioethics and Biosafety, M.K.Sateesh, I.K.International 2008
2. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2005
3. Projects: Planning, Analysis, Selection, Implementation & Review, Prasannan Chandra, Tata McGraw-Hill Publishing Co. 1997.
4. www.icmr.nic.in (ethical guidelines for biomedical research).

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Integrated Biotechnology
Syllabus: Semester -IX
PRACTICALS
IBT – 905

Instrumentation Techniques and Biodiversity

1. Analysis of Na, K/Mg by flame photometer.

2. Ion analysis by electrode method in water and soil.

3. Plotting of absorption spectrum of chlorophylls/bacterial pigments, proteins/nucleic acids.

4. Functional group identification from IR spectrums.

5. Chromatographic separation of amino acids/carbohydrates/plant secondary metabolites by thin layer chromatography.

6. Isoenzyme analysis by gel electrophoresis (Glucose 6 phosphate dehydrogenase/ peroxidase/catalase).

7. Diversity analysis (plants/ microbes) by molecular markers.

8. **Biodiversity:** (Any one of the following- student will submit it in the form of a report and viva will be conducted during the practical examination-10 marks can be allotted for this exercise)
    a. Diversity analysis of forest ecosystem.
    b. Microbial Diversity analysis of any one ecosystem (qualitative and quantitative).
    c. Diversity of plankton in pond ecosystem.

9. **Lab visits:** Demonstration of the working principle and application of the following Instruments:
    a. HPTLC.
    b. HPLC.
    c. IR.
    d. DNA Sequencer.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

M. Sc. Integrated Biotechnology
Syllabus: Semester -IX
PRACTICALS
IBT – 906

Advances in Molecular Biology

1. DNA detection and characterization by gel electrophoresis.

2. SDS-PAGE analysis of proteins.

3. Identification of N-Terminal amino acid of a protein.

4. Isolation of lysozyme enzyme using cation exchange chromatography.

5. To perform restriction digestion of DNA.

6. Alkaline phosphatase treatment of DNA restriction fragments.

7. Isolation of chromosomal DNA from *Saccharomyces cerevisiae*.

8. Tansformation of *Saccharomyces cerevisiae*.

9. Southern transfer of DNA from agarose gel onto nitrocellulose or nylon membrane.

10. In vitro synthesis of specific DNA fragments with the polymerase chain reaction.