M.Sc. (Life Science)
(III and IV semester exams 2016-17)
Scheme of Examination and Courses of study

1. The M.Sc. course in Life Science is a two year full time curriculum offered in the form of Choice-based Credit System organized in four semesters. The number of papers and maximum marks for each theory paper/practical has been shown in the syllabus. It will be necessary for a candidate to pass in the theory part as well as in the practical part (wherever prescribed) separately.
2. The course of study for M.Sc. (Life Science) examination shall be spread over a period of two years with examination at the end of each semester. There shall be **four semesters** in all.
3. Syllabus of every paper of each semester will be divided into 5 units.
4. Scheme of examination

Semester III	MaxMarks	MinMarks	InterAsse.
Paper I	70	25	30
Paper II	70	25	30
Paper III	70	25	30
Paper IV	70	25	30
Practical	200	72	Nil

Note: An aggregate of 50% marks is required to pass a semester.

Semester III

Paper IX – Genetic Engineering & Bio-Informatics
Paper X- Biotechnology
Paper XI- Biodiversity
Paper XII – Biostatistics & Biophysics

PAPER- LS–09 Genetic engineering and Bioinformatics

Min. Pass. Marks -29 Duration - 3 Hrs. Max. Marks: 80

UNIT 1

1. Definition, Steps, Restriction endonucleases and essential Enzymes used in r-DNA technology
2. Cloning Vectors [Plasmid, Bacteriophage, Cosmid, Phasmid, Artificial chromosomes (BAC, YAC, Shuttle Vector)]
3. Identification and analysis of recombinant DNA clones.
4. Applications of r-DNA technology- Requirement and production of recombinant molecules in pharmaceutical, health, agricultural and industrial sectors and research laboratories.

UNIT II

1. DNA Sequencing method: Dideoxy and chemical method, sequence assembly.
2. Gene amplification. PCR types and its applications.

3. Molecular marker – PCR based or non PCR based markers.
4. Gene library: genomic library and c-DNA library.

UNIT III

1. Genetic engineering of plants: Gene transfer in plants – Vector mediated gene transfer (Ti plasmid) and direct gene transfer. Genetically transformed plants. T-DNA and transposon mediated gene tagging, chloroplast, transformation.
2. Methods of gene transfer in animals Transgenic animals (Sheep and Goat) Gene Therapy.
3. Genetic Counseling, DNA finger printing.
4. Human Genome Project: History and current status. Safety of recombinant DNA technology, IPR and patenting. Basic patent rules ethical issues. Bio safety regulations and its utility.

UNIT IV

1. Bioinformatics: Definition, Introduction, Historical resume, Bioinformatics Career – future prospects and ethical issues.
2. Basic Components of computers and their functions Hardware and Software, Input Output devices. Network: Definition and types (LAN,WAN).
3. Basic Concepts about data and information: Representation of data in Computer in binary, bits and bytes. Conceptual understanding of assemblers and Compilers operating system.
4. Biological Databases: Primary sequence databases (Protein and DNA databases), Secondary databases, Composite databases.

UNIT V

1. Nucleic acid sequence analysis, alignment, similarity searches including remote similarity searches, secondary structure element, motifs.
2. Protein sequence analysis, alignment, similarity searches including remote similarity searches, secondary structure element, motifs.
3.Genomics and annotation Evolutionary analysis; use of the PHYLIP package, tree construction.
4. Role of bioinformatics in Pharmaceuticals industry Challenges of Commercialization of Bioinformatics and its future prospects.

Reference Books:

1. **Bioinformatics (2002) Bishop Martin.**
2. **Molecular database for protein & Sequence & Structure Studies: Sillince A. and Sillince M.**
3. **Sequence analysis Primers: Gribskov, M. & Devereux, J.**
4. **Molecular biotechnology: S.B. Primrose.**
5. **'Gene VII' by Lewin Benjamin (Oxford).**
6. **'Genome' by T.A. Brown, John Wiley & Sons.**

7. **'Molecular Biology of the Gene' by Watson-Barker-Bell-Gann-Levine-Losick, 5th Edn. Pearson Education.**

Paper - LS –10 Biotechnology

Min. Pass. Marks: 29 Duration - 3 Hrs. Max. Marks:80

UNIT I

1. General introduction: Meaning, brief history, biotechnology in India, Scope and importance.
2. Recombinant DNA and Gene Cloning, Molecular Probes.
3. Site directed mutagenesis.
4. DNA Chip Technology and Microarrays.

UNIT II

1. Plant tissue culture: Introduction, history, Scope, concept of cellular Differentiation totipotency.
2. Organogenesis and somatic embryo-genesis and Somatic hybridization, applications of plant tissue cultures
3. Micro-propagation, Virus free plants, artificial or encapsulated seeds, embryo rescue,
4. Production of androgenic haploids, production of triploids, soma clonal variations,. germplasm preservation, Cryopreservation and gene bank.

UNIT III

1. Animal tissue culture: Introduction, Primary culture, cell lines and cloning. Tissue and Organ Culture, IVF, embryo- transfers.
2. Brief discussion on the chemical, Physical and metabolic functions of different constituents of culture medium.
3. Basic technique of mammalian cell cultures in – vitro. Microcarrier culture, cell Synchronization and cell culture..
4. Application of animal cell culture. Hybridoma technology and monoclonal antibodies.

UNIT IV

1. Environmental Biotechnology Current status: Water pollution management solid Waste management, bioindicators of biosurfactants, biofilms etc.Current status of Biotechnology in environmental protection, concept of cleaner technology.
2. Biotechnology for pollution abatement: Bio scrubbers and Biofilters, Biotechnology for air and water pollution abatement.
3. Bio-magnifications: Biomagnification of Pesticides and heavy metals.
4. Bio-insecticide: Brief account, application for productivity improvement and crope protection. Microbial pesticides, Bt. insecticides, Neem insecticide. Bio Sensor, Biomining, Bioremediation, Bio surfactant and Bio film.

UNIT V

1. Industrial Biotechnology: Alcohol and Beverages production, food products - cheese and bread, acid production, vitamin, enzyme production, Antibiotics, Amino acid production. Biotransformation and Bioleaching.
2. Agricultural biotechnology: Biofertililzers, Biotechnology of Nitrogen fixation, Biopesticides, production of Biogas and ethanol.
3. Medical Biotechnology: Synthesis of proteins and hormones, production of interferons and other immunoproteins.
4. Production of vaccines, antibodies, Steroids.

Reference Books:

1. Freshney, Culture of Animal Cells, 5th Edition, Wiley-Liss, 2005.
2. Ed. John R.W. Masters, Animal cell Cultures- Practical Approach, 3rd Edition, Oxford University Press,2000.
3. Plant tissue Culture by M.K. Razdan & S.S. Bhojwani (1996) Elsevier.
4. Plant tissue culture Concepts and laboratory Exercises, Second Edition, Robert N. Trigiano, Dennis J. Gray, CRC Press, November 1999.
5. Environmental Biotechnology By S.N. Jogdand, Himalaya Publishing.
6. Prescott & Dunn (2002) Industrial Microbiology, Agrobios (India) Publishers.
7. S.N. Jogdan (2006) Industrial Biotechnology, Himalaya Publishing House

Practical Exercises IX & X

1. Isolation of plant DNA.
2. Estimation of RNA by Orcinol method.
3. Restriction, Digestion of plant DNA, its separation by Agarose gel elcctrophoresis and visualization by ethidium bromide staining:
4. Isolation of protoplasts from different tissues using commercially enzymes.
5. Separation of Cell organelle by sucrose gradient.
6. Extraction and estimation al phenol based secondary metabolites.
7. Principle and use of laboratory equipments: pH Metre, Autoclave, Centrifuge Balance, Spectrophotometer.
8. Acquaintance with tissue culture laboratory.
9. Preparatory techniques: Washing of Glassware, Dry and Steam sterilization, sterilization techniques.
10. Preparation of Culture media.
11. Demonstration of the technique of Micropropagation by using different explants eg. Shoot Meristem, axillary bud, callus induction, regeneration.
12. Demonstration of the technique of anther culture.
13. Sequence alignment.
14. Homology finding by using BLAST,FASTA.
15. Database sequencing.

Paper - LS 11 Biodiversity

Min. Pass. Marks -29 Duration - 3 Hrs. Max. Marks: 80

Unit – I

1. Algae in diversified habitat, classification of Algae, Evolutionary trends in Algae.
2. Algal blooms, algae as brofertilizers, food, fuel and uses in industries, algae in symbiotic association and pollution indicator.
3. General account of fungi and classification. Role of fungi in industries and medicines. Lichenology: General account on lichens.
4. Mycorrhizal application in agriculture and plant growth, mycorrhiza as biocontrol agent.

Unit - II

1. Bryophyta : Salient features, classification, origin and distribution of Bryophytes.
2. Pteridophyta : Salient features, classification of pteridophytes. Evolution of stele, heterospory.
3. Gymnosperms: Salient features, Evolution, classification and their distribution in India.
4. Angiosperms: Classification, The species concept, principles used in assessing. relationship. International code of Botanical nomenclature.General account on botanical gardens and herbaria, BSI.

Unit -III

1. Principles of Taxonomy and classification of non-chordates and chordates upto orders with salient features and examples.
2. Protozoans and helminthes of medical importance; Origin of Metazoa, metamerism and symmetry; sponge industry; Polymorphism in coelentrates; Coral reefs; Parasitic adaptations in helminthes. Types and significance of coelom with examples.
3. Economic importance of insects (including lac-culture, sericulture and Apiculture); social insects and their life cycle.

Unit – IV

1. Origin of Chordates; Affinities of Hemichordata, Urochordata and Cephalochordata; Retrogressive metamorphosis.
2. General characters, habit, habitat and distribution of Agnatha. Migration and economic importance of fishes.

3. Exotic fishes; Adaptations and parental care in fishes and amphibians; Amphibians as biological control agents; living reptiles; Salient features of Dinosaurs and Archaeopteryx;
4. Aerial adaptations and migration in birds; Salient features and affinities of Prototheria and Metatheria. Ecolocation in Bats; Adaptive radiations in mammals; Evolution of man.

Unit-V

1. Biodiversity : Definition, Magnitude of Biodiversity Levels of Biodiversity (Genetic diversity, species diversity and community and ecosystem diversity.
2. Biodiversity of India and World: Ten bio-geographical regions of India, their specific flora and fauna. Brief idea of hot spots of india and the world.
3. Loss of Biodiversity: Various causes of loss of Biodiversity, Habitat loss & fragmentation, over-exploitation, IUCN Red list categories.
4. Conservation of Biodiversity. : In-situ conservation – (Protected area, Biosphere reserve etc.) ex-situ conservation – cryopreservation, zoological parks.
5. Convention on biodiversity, Habitat loss, IPR patent, PBR (Peoples biodiversity register), Biodiversity act of india 2002.

Reference Books:

1. Myres Biodiversity.
2. V.N. Naik; Taxonomy of Angiosperm.
3. Singh, Jain: Taxonomy of Angiosperm.
4. Pandey, Angiosperm: taxonomy, Anatomy, Economic Botany and Embryology.
5. Dr. S.G. Date,: Key to Family of Angiosperm.
6. Kotpal &S Khetrapal, Invertebrates.
7. S.H. Prater, The book of Indian animal.
8. Ashlock, Principle of Animal taxonomy.

Paper - LS 12 Biostatistics and Biophysics

Min. Pass. Marks -29 Duration - 3 Hrs. Max. Marks: 80

UNIT I

1. Biostatistics Introduction, Statistical Terms and Symbols, Sample and Sampling Techniques.

2. Collection, classification and Tabulation of Data. Frequency distribution, Diagrammatic and Graphical presentation of Data.

3. Measures of Central tendency: Mean, Mode and Median.

4. Measures of Variability or dispersion: range, mean deviation standard deviation.

Unit II

1. Probability and its application. Theoretical distribution: Binomial and Normal distribution.
2. Correlation: types, methods, Coefficient of correlation. Regression analysis: Regression Line, regression equations- of X on Y and Y on X. regression in a bivariate grouped frequency distribution. Multiple regressions.
3. Test of Significance, levels of significance, standard errors, chi-square test.
4. Student `t' test, f – test. Analysis of variance (ANOVA).

Unit III

1. Bioenergetics: Basic bioenergetics. Law of bioenergetics, whole body bioenergetics. Entropy and evolution relationship. Gibbs free energy.
2. Bioenergetic pathways. Bioenergetics and biocommunication. Control of bioenergetics.
3. Molecular interaction: Intra- molecular and Inter- molecular interaction, Attractive and repulsive forces operating within molecules and their overall effects on molecular interactions.

Unit IV

1. Mechano chemical process of muscles contractions Molecular structure of skeletal muscles - actin, myosin, troponin, tropomyosin, role of myoglobin.
2. Physicochemical process of nerve impulse conduction across Myelinated, non myelinated and synaps.
3. Physicochemical process of vision, colour determination and sound perception by animal, echo location.
4. Biophysics of circulation in animal and water transport and nutrient translocation in plants.

Unit V

1. Methods to elucidate structure and biochemical compounds found in living organisms- Centrifugation, Electrophoresis, Tracer techniques, autoradiography.
2. Chromatography (Paper, Thin layer and column chromatography), Spectrophotometry (UV, VIS, IR, NMR and ESR), Electron microscopy (TEM,SEM) X- ray diffraction.
3. Chemical fingerprinting: Basic problems in chemical finger printing of plants.
4. Bioelectronics: Biological manipulation of Cellular engineering. Biologically inspired computing.

Reference Books:

1. Biostatistics: P.N. Arora, P.K. Malha.
2. Biostatistics: S.K. Gupta.
3. Introductory Statistics for Biology: S.K. Mahajan.
4. Biophysics by N. Roy.
5. Biophysics- V. Pattabhi & N. Gautham (Narosa, New Delhi).
6. Biophysical Chemistry Vol.II- C.R. Cantor & P.R. Schimmel,(W.H. Freeman & Co.).

Practical Exercises XI & XII

1. Exercise based on presentation of Data, Simple and Complex Table, Graphs, Pie Charts.
2. Exercise based on Classification of Data, Frequency and Frequency distribution.
3. Numerical problems based on measures of central Tendency-Mean, Mode and Median
4. Chi square and Student t-test.
5. Morphological study of representative members of algae, fungi, bacteria, bryophytes and pteridophytes:Microcystis, pediastrum, Hydrodictyon, Ulva, pithophora, Sitgeoclonium, Drapranldiopsis, Closterium, Cosmarium, Chara,peronospora, Albugo, Mucor, pilobolus, yeast, Chaetomium, Pleospora, Morchella, Melampspora, Phallus, Polyporus, Drechslera, Phoma, Penicillium, Aspergillus, Colletotrichum, Marchantia, Anthoceros, Polytrichum, Psilotum, Lycopodium, Selaginella, Equisetum, Gleichenia, pteris, Ophioglossum, Isoetes.
6. Symptomology of some diseased specimens: White rust, downy mildew, powdery mildew, rusts, smuts, ergot, groundnut leaf spot, red rot of sugarcane, wilts, paddy blast, citrus canker, bacterial blight of paddy, leaf curl of papaya, tobacco mosaic, little leaf of brinjal, seasame phyllody, mango malformation.
7. Description of various species of a genus; location of key characters and preparation of key generic level.
8. Field trips within and around the campus; compilation of field notes and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant.
9. Identification of specimens described in the class.
10. Culture preparation: Paramecium and Euglena Study of response of paramecium/ earthworm to different stimuli.
11. Economic importance of any two animals of each phyla.

Mouth parts of insects: cockroach, honeybee, mosquito, house-fly and butterfly