

Syllabus and Course Scheme
Academic year 2014-15



MASTER OF SCIENCE IN LIFE SCIENCE
DEPARTMENT OF LIFE SCIENCE
UNIVERSITY OF KOTA
MBS Marg, Swami Vivekanand Nagar,
Kota - 324 005, Rajasthan, India
Website: uok.ac.in

University of Kota, Kota

M.Sc. (Life Science) Exam. 2015

Eligibility:

B.Sc. (under 10+2+3 scheme) with Chemistry, Botany, Zoology, Biotechnology, and Microbiology with a minimum of 50% marks.

(45% for candidates belonging to the reserved category SC/ST/OBC)

About Life Sciences

The life sciences comprise the [fields of science](#) that involve the scientific study of [living organisms](#) such as [microorganisms](#), [plants](#), [animals](#), and [human beings](#). The applied sciences draw from the fundamentals that are taught in the programme and focus attention on the medical field. This acts as a launch pad for careers in diverse fields, ranging from purely academic endeavour such as research and teaching to entrepreneurship, law, science writing etc. The programme is designed to strengthen and enhance a student's understanding and knowledge of Biology by exposure, over a two year period four semester, to several fields such as Cell Biology, Physiology, Genetics, Immunology, Microbiology etc in mainstream biology and allied fields such as Biochemistry, Biostatistics, Pharmacology, Forensics etc. This allows students to make more informed choices when planning a career. This programme is conducted by the faculty of the department using a blended learning approach which includes classical classroom teaching, self study, experiential learning, seminars, presentations, field visits etc. Life science department focus on a specific type of life. For example, [zoology](#) is the study of [animals](#), while [botany](#) is the study of [plants](#). Other life sciences focus on aspects common to all or many life forms, such as [anatomy](#) and [genetics](#). Yet other fields are interested in [technological](#) advances involving living things, such as [bio-engineering](#). Another major, though more specific, branch of life sciences involves understanding the [mind](#) – [neuroscience](#). The life science is are helpful in improving the quality and standard of life. It has applications in health, agriculture, medicine, and the pharmaceutical and food science industries.

Employability

Masters program (M.Sc.) in Life Sciences has been started with a motto “Nurturing Science, Knowledge and Innovation”. The M.Sc. programme is focused on multi disciplinary research based learning with emphasis on individual seminars, projects and experiments.

Careers in Life sciences can be into:

Pharma companies: The posts include Medical Representative, area business manager, district manager, drug analyst.

Forensic departments: One can get jobs in the Labs of CID, FBI, to analyse the crime samples and solve the cases by revealing the genetic mysteries,

Drug companies,

Diesel and petrol boards: For their purification and synthesis through biological methods,

Agriculture departments: for producing hybrid crops and GMO's to increase the crop production,

Research: One can do research on various microbes, disease, Plants, animals, etc.,

Lecturership: One can go for the NET/SET exam after M. Sc. to become a lecturer.

Analytical Toxicology -Toxicologists plan and carry out investigations to determine the impact of toxic materials and advise on the treatment of affected patients.

Anatomical pathology - a vital area concerned with understanding and identifying the causes of death, and assisting doctors with post mortems.

Biomedical science - carrying out a range of laboratory and scientific tests to support the diagnosis and treatment of disease.

Blood sciences - in hospitals, blood from donors is matched so that it can be given to patients when needed.

Clinical biochemistry - Healthcare science staff help diagnose and manage disease through the analysis of blood and other body fluids.

Clinical immunology - concentrates on conditions that affect the immune system.

Cytopathology and cervical cytology - as well as screening cervical smears, healthcare science staff prepare and examine a range of other cellular samples to look for signs of abnormality.

External quality assurance - monitoring the quality of a variety of diagnostic tests.

Genetics, Haematology (including haemostasis and thrombosis), Histocompatibility and immunogenetics, Histopathology. Microbiology - the study of organisms (bacterial, viral, fungal and parasitic) that cause infections.

Phlebotomy - taking blood samples to help diagnose or monitor disease.

Reproductive science - a dynamic area dealing with infertility treatments, such as IVF, and other programmes.

Virology - the study of viral infections, such as rubella, herpes, hepatitis and HIV. And many more jobs in labs including CSIR, CSIO, DRDO. Life Science is a popular subject in India and abroad with lot of career opportunities.

Scheme of Examination and Courses of study

1. The number of papers and maximum marks for each theory paper/practical have 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-

All Semesters shall be examined by following scheme:

	Max Marks	Min Marks	Inter Asse.
Paper I	80	29	20
Paper II	80	29	20
Paper III	80	29	20
Paper IV	80	29	20
Practicals	200	72	

An aggregate of 40% marks is required to pass a semester.

There will be one term test (multiple choice questions) of 40 marks comprising of 40 questions from all 4 papers of 45 minutes duration in each semester. Remaining 40 marks are reserved for seminar presentation during the course of the study period in each semester.

Semester I

LS 01 – Cell Biology

LS 02- Molecular Biology

LS 03- Genetics

LS 04 – Biological Tools, Techniques & Research Methodology

Practicals Day 1- LS01, LS02

Day 2- LS03, LS04

Semester II

LS 05– Microbiology

LS 06- Biochemistry

LS 07- Ecology

LS 08– Evolution and Animal Behavior

Practicals Day 1- LS05, LS06

Day 2- LS07, LS08

Semester III

LS 09– Genetic Engineering & Bio-Informatics

LS 10- Biotechnology

LS 11- Biodiversity

LS 12 – Biostatistics & Biophysics

Practicals Day 1- LS09, LS10

Day 2- LS11, LS12

Semester IV

LS13– Environmental Sustainability

LS14 - Animal Physiology

LS15 - Plant Physiology

LS16 – Immunology

Practicals Day 1- LS13, LS14

Day 2- LS15, LS16

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, Procedure, 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 in pharmaceutical, health, agricultural and industrial sectors.

UNIT II

1. DNA Sequencing method.
2. Gene amplification. PCR types and its applications, Molecular marker – PCR based or non PCR based marker,
3. Gene library: genomic library and c-DNA library, Genetic Counseling, DNA finger printing.
4. Human Genome Project: History and current status.

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.
3. Gene Therapy: somatic and germline, gene replacement, gene delivery.
4. Safety of recombinant DNA technology, IPR and patenting, Basic patent rules, ethical issues, Bio safety regulations and its utility.

UNIT IV

1. Bioinformatics: Definition, Historical resume, 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: History, Biotechnology in India, Scope and importance.
2. Recombinant DNA and Gene Cloning, Molecular Probes.
3. Site directed mutagenesis.
4. DNA Chip Technology and Microarray.

UNIT II

1. Plant tissue culture: Introduction, history, Scope, concept of cellular Differentiation, totipotency.
2. Organogenesis, somatic embryo-genesis, Somatic hybridization, applications of plant tissue culture.
3. Micro-propagation, Virus free plants, artificial or encapsulated seeds, embryo rescue,
4. Production of androgenic haploids, production of triploids, somaclonal 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- transfer.
2. Brief discussion on the chemical, Physical and metabolic functions of different constituents of culture medium.
3. Basic technique of mammalian cell culture, 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 cleaner technology.
2. Biotechnology for pollution abatement: Bio scrubbers and Biofilters, Biotechnology for air and water pollution abatement.
3. Biomagnification of Pesticides and heavy metals.
4. Bio-insecticide: Brief account, application for productivity improvement and crop protection. Microbial pesticides, Bt. insecticides, Neem insecticide. Bio-Sensor, Bio-mining, Bio-remediation.

UNIT V

1. Industrial Biotechnology: Alcohol and Beverage production, food products - cheese and bread, acid production, vitamins, enzyme production, Antibiotics, amino acid production. Biotransformation and Bioleaching.
2. Agricultural biotechnology: Biofertilizers, Biotechnology of Nitrogen fixation, 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.
8. K.G. Ramawat and S. Goyal 2014 comprehensive Biotechnology, S.Chand & Co. New Delhi.

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 electrophoresis 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 of 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 biofertilizers, 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- Cyclostomata. Migration and economic importance of fishes.
3. Exotic fishes; Adaptations and parental care in fishes and amphibians; Amphibians as biological control agents; 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 Khetrpal, 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. Molecular structure of skeletal muscles – (actin, myosin, troponin, tropomyosin), role of myoglobin, Mechanochemical process of muscles contractions.
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, Melampsora, 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, sesame 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.
12. Mouth parts of insects: cockroach, honeybee, mosquito, house-fly and butterfly.