GULBARGA UNIVERSITY

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ನುಗಳೆ ಸರ್,

ಅಂಗುಲಪ್ರಭೃತಿಯ ಸಾರುಗಿದ್ದ ಕಾರ್ಯಕ್ರಮದ ಸಮರ್ಪಣದ ಅಧಿಕಾರ ಮತ್ತು ಮೂಲಕ ಅಷ್ಟೇ ಅನುಸರಣೆಯಾಗಿ ಕರೆಯುವವನ್ನು, ಅಧಿಕಾರಿಗಳಾದ ಮಟ್ಟಿನದರಿಂದ,

ಪ್ರತ್ಯೇಕಿಸಿದೆ:
1) ಅನುಭವ ಓದಿಗೆ ರೈತಿಸಿ ಸಂಖ್ಯೆ: 13.06.2018.
2) ಅನುಭವ ಓದಿಗೆ ರೈತಿಸಿ ಸಂಖ್ಯೆ: 14.06.2018.
3) ಅನುಭವ ಓದಿಗೆ ರೈತಿಸಿ ಸಂಖ್ಯೆ: II ರೈತಿಸಿ, 26.06.2018.

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2. ಮಾಹಿತಿ ಇರುವ ಪ್ರತಿ ಆರೋಪಿಸಿದಾರು. ವಿದ್ಯಾರ್ಥಿ ವಿದ್ಯಾರ್ಥಿಗಳ ಮತ್ತು ವಿದ್ಯಾಲಯ ವಿದ್ಯಾರ್ಥಿಗಳು www.gug.ac.in ಎನ್ನು ವಿದ್ಯೋತ್ಸವದ ಹೆಸರು.


1. ಅನುಭವಿಸಿದ್ದರೆ, ಅನುಭವಿಸಿದ ಸ್ವತಂತ್ರ ಮುಂದಾಥೆ, ಭಾರತಾಧಿಕಾರಿ.
2. ತನ್ನ ಸ್ವತಂತ್ರ ಮುಂದಾಥೆಯನ್ನು ಸಂಕೀರ್ಣಿಸಿಕೊಂಡಿರಬೇಕು.

ಇದರಂಭ:

1. ಆದರೆ, ಅನುಭವಿಸಿದ ಸ್ವತಂತ್ರ ಮುಂದಾಥೆ, ಭಾರತಾಧಿಕಾರಿ.
2. ಆದರೆ (ಸ್ವತಂತ್ರ ಮುಂದಾಥೆ), ವಿದ್ಯಾರ್ಥಿ ಸ್ವತಂತ್ರ ಮುಂದಾಥೆ, ವಿದ್ಯಾಲಯ ವಿದ್ಯಾರ್ಥಿ.
3. ತನ್ನ ಸ್ವತಂತ್ರ ಮುಂದಾಥೆ, ವಿದ್ಯಾರ್ಥಿಗಳು ಮತ್ತು ವಿದ್ಯಾಲಯ ವಿದ್ಯಾರ್ಥಿಗಳು ಸಂಕೀರ್ಣಿಸಿಕೊಂಡಿರಬೇಕು.
4. ಪ್ರತ್ಯೇಕಿಸಿದರು, ಭಾರತಾಧಿಕಾರಿ.
5. ಅನುಭವ ಸ್ವತಂತ್ರ ಮುಂದಾಥೆಯನ್ನು ಸೂಚಿಸಿದರೆ ಅನುಭವ ಪ್ರತ್ಯೇಕಿಸಿದರು.
6. ಸ್ವತಂತ್ರ ಮುಂದಾಥೆ, ಭಾರತಾಧಿಕಾರಿ.
7. ಸ್ವತಂತ್ರ ಮುಂದಾಥೆ / ಸ್ವತಂತ್ರ ಮುಂದಾಥೆಯನ್ನು ಸಂಕೀರ್ಣಿಸಿಕೊಂಡಿರಬೇಕು.
GULBARGA UNIVERSITY, KALABURAGI

Faculty of Science and Technology

Syllabus for
B. Sc Course with Biotechnology
Choice Based Credit System (CBCS)

(With Effect from Academic Year 2018-19)

BACHELOR OF SCIENCE (B.Sc.)
BIOTECHNOLOGY
Semester-Wise Syllabus in CBCS Pattern
(WITH EFFECT FROM 2018-2019)

Department of Post Graduate Studies and Research in Biotechnology
Gulbarga University, Kalaburagi- 585106,
Karnataka, India
2018

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The Course structure offered for B.Sc. course with Biotechnology at Gulbarga University, Kalaburagi effective from the academic year 2018-19.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Course code</th>
<th>Course title</th>
<th>Credits L+P</th>
<th>Teaching hours/week L+P=Total</th>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>Core courses</td>
<td>CCBTT-1</td>
<td>Cell Biology and Biochemistry</td>
<td>4+2=6</td>
<td>4+2=6</td>
</tr>
<tr>
<td>II</td>
<td>CCBTT-2</td>
<td>Genetics and Molecular Biology</td>
<td>4+2=6</td>
<td>4+2=6</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>CCBTT-3</td>
<td>Microbial Technology and Immunotechnology</td>
<td>4+2=6</td>
<td>4+2=6</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>CCBTT-4</td>
<td>Genetic Engineering</td>
<td>4+2=6</td>
<td>4+2=6</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Skill Enhancement courses</td>
<td>SECBTT-1</td>
<td>Forensic Science and Environmental monitoring</td>
<td>1+1=2</td>
<td>1+1=2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SECBTT-2</td>
<td>Biotechnology for Human welfare</td>
<td>1+1=2</td>
<td>1+1=2</td>
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<tr>
<td></td>
<td>Discipline Specific Elective Course</td>
<td>DSEBTT-1</td>
<td>Plant and Animal Biotechnology</td>
<td>4+2=6</td>
<td>8+4=10</td>
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<tr>
<td>VI</td>
<td>Skill Enhancement Courses</td>
<td>SECBTT-3</td>
<td>Industrial Biotechnology</td>
<td>1+1=2</td>
<td>1+1=2</td>
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<td>SECBTT-4</td>
<td>Bioinformatics</td>
<td>1+1=2</td>
<td>1+1=2</td>
</tr>
<tr>
<td></td>
<td>Discipline Specific Elective Course</td>
<td>DSEBTT-2</td>
<td>Project work</td>
<td>4+2=6</td>
<td>8+4=10</td>
</tr>
</tbody>
</table>

Total credits for Biotechnology Courses 44
B. Sc. I Semester  
CCBTT-1. Cell Biology & Biochemistry  
60 hrs

Part A: Cell Biology
Unit 1 Cell, Structure & Functions  
15 hrs
1.1 Discovery of cell, The Cell theory, Cell as a basic unit of life
1.2 Ultra structure of a prokaryotic cell (E. coli)
1.3 Ultra structure of a eukaryotic cell- (both plant and animal cells)
1.4 Cell Membrane and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, Membrane as a dynamic entity, Cell recognition and Membrane transport (Simple diffusion, Facilitated diffusion and Active transport)
1.5 Structural organization of cell wall of eukaryotes (plant) & prokaryotes (Gram-negative & positive bacteria).
1.6 Structure and functions of cell organelles (Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplasts, Ribosomes, Liposomes, Peroxisomes, Nucleus, Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).
1.7 Chromosomes- Discovery, morphology and structural Organization-Centro mere, secondary constriction, telomere, chromomere, euchromatin and heterochromatin, chemical composition and karyotype. Structure of specialized chromosomes (Polytene & Lampbrush)

Unit 2. Cell division & Motility  
12 hrs
2.1 Cell cycle, mitosis and meiosis 4hrs
2.2 Stem cell, its origin & their applications
2.3 Cell Senescence and Programmed Cell Death, Apoptosis in relation with Cancer.
2.4 Cell Motility Amoeboid, Ciliary and Flagellar movements

Part B: Biochemistry
Unit 3. Biomolecules  
18 hrs
3.1 Amino acids: Classification and properties
3.2 Proteins: Classification based on structure and functions, structural organization of proteins (primary, secondary, tertiary and quaternary structure).
3.3 Enzymes: Nomenclature and classification of Enzymes, Holoenzyme, apoenzyme, Cofactors, coenzyme, prosthetic groups, enzyme kinetics, factors influencing enzyme activity.
3.4 Carbohydrates: Structure, Function and properties of Monosaccharides, Disaccharides and Polysaccharides. Carbohydrates as a source of energy, Bacterial cell wall polysaccharides, Oxidation, Reduction.
3.5 Lipids: Structure, Functions, Properties & Classification
3.6 Vitamins: Soluble and fat-soluble vitamins, Dietary sources & Functions & deficiency disorders of vitamins.
3.7 Hormones: Structure and importance in brief
Unit 4. Bioenergetics of biomolecules 15 hrs
4.1 Glycolysis
4.2 Gluconeogenesis and its significance
4.3 TCA Cycle, electron transport, Oxidative phosphorylation
4.4 B-oxidation of fatty acid
4.5 Urea cycle and regulation
4.6 Biosynthesis and regulation of purine and pyrimidine nucleotides, de novo and salvage pathways
4.7 Photosynthesis – Light reaction and photophosphorylation

PRACTICALS
1. Study of plasmolysis and de-plasmolysis.
2. Cell fractionation and determination of enzyme activity in organelles using sprouted seed or any other suitable source.
3. Use of Micrometer and calibration, measurement of onion epidermal cells and yeast.
4. Cell division Mitotic (Onion root tips) and meiotic (Onion flower bud’s/grasshopper testes).
5. Mounting of polygene chromosomes
6. Isolation of chloroplasts and mitochondria
7. Determination of - pH optima, temperature optima, Km value, Vmax value,
8. Estimation of blood glucose by glucose oxidase method.
10. Separation of Amino acids by paper chromatography.
11. Estimation of reducing Glucose Maltose and lactose by DNS.
12. Estimation of Protein by Biuret and Lowry’s method.
13. Qualitative and quantitative analysis of DNA using spectrophotometer
15. Separation of Sugars by TLC.

Recommended books

Cell Biology
3. Animal Cytology & Evolution-MJD. White Cambridge University Publications
7. Cell Biology-Ambrose & Dorothy M Easty, ELBS Publications
8. Fundamental of cytology sharp, Mc Graw Hill Company
10. Molecular Biology-smith Faber & Faber Publications
11. Cell Biology &Molecular Biology EDP Robberies & EMF Robberies, Saunder
Biochemistry
1. Lehninger Principles of Biochemistry by: David L. Nelson and Cox
2. Biochemistry by: Rex Montgomery
4. Enzymes By: Trevor Palmer
5. Principles of Biochemistry By: Donald J. Voet, Judith G. Voet, Charlotte W. Pratt
6. Analytical Biochemistry by Cooper
7. Experimental Biochemistry: A Student Companion by Sashidhar Rao and Despande et al
8. Practical Biochemistry by Plummer
9. Practical Biochemistry by Vijaykumar Biradar & Ashwini S.

B. Sc. II Semester
CCBTT-2. Genetics & Molecular Biology

Unit 1. 12 hrs
1.1 Mendel’s experiments – Factors contributing to success of Mendel’s experiments
1.2 Law of segregation – Monohybrid ratio
1.3 Law of independent assortment – Dihybrids, Trihybrids
1.4 Deviation from Mendel’s Laws - partial or incomplete dominance, co-dominance
1.5 Penetrance and expressivity, Pleiotropism
1.6 Interaction of Genes: Supplementary genes (Comb patter in fowls), Complementary genes
   (Flower colour in sweet peas), Multiple genes (skin colour in human beings), Epistasis (Plumage
   colour in poultry), Multiple alleles: Blood groups in human beings.

Unit 2. 18 hrs
2.1 Linkage and recombination –Gene linkage & types, Cytological proof of crossing over,
   Recombination frequency and map distance. Interference and coincidence
2.2 Mechanism of sex determination: Gene balance theory (Drosophila) and Homogametic &
   Heterogametic theory (Human, Mamalian, Birds), X – linked inheritance (Haemophilia, Colour
   blindness)
2.3 Chromosomal Variations: A general account of structural and numerical aberrations,
   chromosomal evolution of wheat and cotton
2.4 Cytoplasmic Inheritance: Plastid inheritance in Mirabilis, Petite characters in yeast and Kappa
   particles in Paramecium
2.5 Mutation: Spontaneous and induced mutations, Mutagens (Physical and chemical), Molecular
   Mutations in plants, animals, and microbes for economic benefit of man.
2.6 Human Genetics: Karyotype in man, Inherited disorders-Allosomal (Klinefelter syndrome and
   Turner’s syndrome) & Autosomal (Down syndrome and Cri-Du-Chat syndrome).

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Unit 3.  
3.1 Molecular of Life: An introduction experimental proof of DNA and RNA as genetic material.  
3.2 Nucleic acid structure: Watson and Crick model of DNA and other forms of DNA (A and Z), Types, structure & functions of RNAs.  
3.4 DNA Replication: Prokaryotic and Eukaryotic DNA replication, Theta model and Rolling circle model.  
3.5 DNA Repair: Causes and mechanism –photo reactivation, excision repair, mismatch repair, SOS repair.  
3.6 Recombination in prokaryotes: Transformations, Conjugation and Transduction.  
3.7 Structure of Prokaryotic and Eukaryotic gene, genetic code, properties and Wobble hypothesis.  

Unit 4.  
4.1 Transcription in Prokaryotes and Eukaryotes, Mechanism, promoters and RNA polymerase, transcription factors, post transcriptional modifications of eukaryotic mRNA.  
4.2 Translation in Prokaryotes and Eukaryotes, Post translational modifications of proteins  
4.3 Regulation of Gene expression: Regulation of Gene expression in Prokaryotes-Operon concept (Lac and Trip)  
4.4 Regulation of Gene expression in Eukaryotes –transcriptional activation, galactose metabolism in yeast  
4.5 Gene organization and expression in Mitochondria and chloroplasts.  
4.6 Insertional elements and transposons, Transposable elements in Maize and Drosophila.  

Practicals
1. Karyotype analysis in Man  
2. Study of monohybrid and dihybrid ratios  
3. Ames test for mutagenic agents  
4. Pedigree charts of some common characters like blood group & color blindness  
5. Isolation of chromosomal DNA from bacteria  
6. Isolation of plasmid from bacteria.  
7. Agarose gel electrophoresis of genomic DNA & plasmid DNA  
8. Preparation of restriction enzyme digests of DNA samples  
Recommended books

**Genetics**
1. Basic Genetics – Daniel L. Hartl Jones & Barlett Publishers USA
   Arnold Publishers London.
   Wiley & Sons.
   Benjamin Cummings.
8. Introduction to Genetic Analysis, by Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll,
    sons Publications.

**Molecular Biology**
   Wiley & Sons. Inc.
   Lippincott Williams and Wilkins, Philadelphia.
3. The World of the Cell. By Becker, W.M., Kleinsmith, L.J., Hardin J. and Bertoni, G. P.

B. Sc. III Semester

CCBTT-3. Microbial Biotechnology & Immunotechnology 60 hrs

Part A: Microbial Biotechnology

**Unit 1.**

1.1 Microorganisms & Classification: Microbial phylogeny and current classification of bacteria.
1.2 Morphology and cell structure of major groups of microorganisms eg. Bacteria, Algae, Fungi,
   Protozoa and Unique features of viruses.
1.3 Nutritional categories of micro-organisms, methods of isolation, Purification and preservation.
1.4 Types of microbial culture and its growth kinetics: Batch, Fedbatch and Continuous culture.
   Measurement of growth.
1.5 Endospores and sporulation in bacteria.

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Unit 2.
18 hrs
2.1 Control of Microorganisms: By physical, chemical and chemotherapeutic Agents
2.2 Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms.
2.3 Important microorganism in food Microbiology: Moulds, Yeasts, bacteria.
2.4 Major food born infections and intoxications, Preservation of various types of foods.
2.5 Fermented Foods: Purification & characterization of proteins, Upstream and downstream processing, solids and liquid handling. Distribution of microbial cells, centrifugation, filtration of fermentation broth, ultra centrifugation, liquid extraction, ion-exchange recovery of biological products. Experimental model for design of fermentation systems
2.6 Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.
2.7 Microbial insecticides; microbial flavours and fragrances, newer antibiotics, anti cancer agents.

Part B. Immunotechnology

Unit 3. 15 hrs
3.1 Immune system: Types, Structure of Immuno-globulins (Antibodies).
3.3 Clonal selection theory, allotypes & idioypes, antibody diversity.
3.4 Major Histocompatibility complexes: class I & class II MHC antigens, antigen processing.
3.5 Immunity to infection, Autoimmune diseases, Immunodeficiency-AIDS.

Unit 4 15 hrs
4.1 Vaccines & Vaccination – adjuvants, cytokines, DNA vaccines, recombinant vaccines, bacterial vaccines, viral vaccines, vaccines to other infectious agents, passive & active immunization.
4.2 Introduction to immunodiagnostics – RIA, ELISA.
4.3 Immune modulators
4.4 cAntigen- Antibody interactions, Cross reactivity, Epitope mapping.
4.5 Identification of immune cells, Antibody engineering, Microarrays

PRACTICALS
1. Isolation of chromosomal DNA from E. coli
2. Plasmid DNA isolation
3. Staining methods: Gram’s staining, Acid fast staining, Capsule staining and spore staining,
4. Study of motility of bacteria by hanging drop.
5. Preparation of media & sterilization methods, Methods of Isolation of bacteria from different sources.
7. Analysis of water quality by MPN test
8. Production and analysis of ethanol.
9. Production and analysis of lactic acid.

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11. Differential leucocytes count
12. Total leucocytes count
13. Haemagglutination inhibition assay
14. Separation of serum from blood
15. Double immunodiffusion test using specific antibody and antigen.
16. ELISA.

Recommended books

**Microbial Biotechnology**
1. Text Book of Biotechnology - By H.K. Das (Wiley Publications)
2. Biotechnology - By H.J. Rehm and G. Reed. VIH Publications, Germany
3. Biogas Technology - By b.T.Nijaguna
4. Biotechnology - By K.Trehan
5. Industrial Microbiology - By L.E.Casida
6. Food Microbiology - By M.R. Adams and M.O.Moss
7. Introduction to Biotechnology - By P.K.Gupta
8. Essentials of Biotechnology for Students - By Satya N.Das

**Immunotechnology**
7. Biotechnology. By Dubey

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B. Sc. IV Semester
CCBTT-4, Genetic Engineering 60 hrs

Unit 1. 16 hrs
1.1 Molecular tools and applications - restriction enzymes, ligases, polymerases, alkaline phosphatase. Types of cloning vectors & Shuttle vectors, Microinjection,
1.1 Electroporation, Ultrasonication.
1.2 Principle and applications of Polymerase chain reaction (PCR), RT- (Reverse transcription) PCR. 1.3 Southern and Northern hybridization.

Unit 2. 16 hrs
2.1 Preparation of Genomic and cDNA library, Screening of recombinants, Reverse 2.2 Transcription, Applications of Genetic Engineering
2.3 Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines (one example each).

Unit 3. 10 hrs
3.1 Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis.
3.2 Gene shuffling, production of chimeric proteins, Protein engineering concepts and examples (any two).

Unit 4. 18 hrs
4.1 Introduction to Genomics, DNA sequencing methods: Maxam & Gilbert method, and Sangers method.
4.2 Introduction to Proteomics, Analysis of proteomes. 2D-PAGE. Sample preparation, solubilization, reduction, resolution.
4.3 Reproducibility of 2D-PAGE. Mass spectrometry based methods for protein identification. De novo sequencing using mass spectrometric data.
4.4 Human genome project, Human genetic engineering-problems & ethics
4.5 Biosensors & Nanotechnology and their applications.

PRACTICALS
1. Isolation of Chromosomal DNA from bacteria
2. Isolation of plasmid from bacteria
3. Restriction digestion of DNA
4. Ligation of DNA fragments
5. Making competent cells
6. Transformation of competent cells.
7. Demonstration of PCR using thermocycler
8. Demonstration Western blotting technique
9. Study of conjugation process

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Recommended books

V SEMESTER
SECBTT-1. Forensic science & Environmental monitoring 15 Hours
Part A. Forensic science
Unit 1.
1.1 Introduction and principles of forensic science, forensic science laboratory organization, Service, tools and techniques in forensic science, Branches of forensic science,
1.2 Causes of crime, Role of modus operandi in criminal investigation. Classification of injuries and their medico-legal aspects,
1.3 Method of assessing various types of deaths.
1.4 Classification of firearms and explosives, Introduction to internal, external and terminal ballistics. Chemical evidence for explosives.
Unit 2.
2.1 General and individual characteristics of handwriting, Examination and comparison of handwritings and Analysis of ink various samples.
2.2 Role of the toxicologist, Significance of toxicological findings.
2.3 Fundamental principles of fingerprinting, Classification of fingerprints, Development of fingerprint as science for personal identification.
2.4 Principle of DNA fingerprinting. Application of DNA profiling in forensic medicine,
2.5 Investigation Tools, Evidence Preservation, Search and Seizure of Computers, Introduction to Cyber security.
04 Hours

Part B. Environmental monitoring
Unit 3.
3.1 Modern fuels and their environmental impact: Biogas, Biohydrogen gas & Bioethanol production.
3.2 Bioremediation of soil & water contaminated with oil spills, heavy metals and detergents.
3.3 Phyto-remediation. Degradation of pesticides and other toxic chemicals by micro-organisms (degradation chlorinates, hydrocarbons).
3.4 Solid waste disposal & monitoring methods (Composting, Vermicomposting)
3.5 Liquid waste disposals & sources, Treatment of municipal waste and Industrial effluents.
3.6 Biomining & extraction of pure metal by microbes 07 Hours
PRACTICALS

1. Collection and Handling of toxicological samples
2. Collection and Handling of Petroleum samples.
3. Collection and Handling of murder case samples
4. Collection and Handling of toxicological samples
5. Study of Bomb Blast scene
6. Collection and Handling of firing crime scene samples
7. Collection and Handling of Hit and run crime scene samples
8. Collection and Handling of fire crime scene samples

Recommended books

Forensic Science


Environmental Monitoring

2. Laboratory Analytical Techniques Series (LATS), published by CPCB.

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B. Sc. IVA Semester
SECBTT-2. Biotechnology for Human Welfare  15 Hours

UNIT-I
GM crops: Herbicide resistant crops; insect resistant crops; disease resistant crops; stress tolerant crops; improvement of crop yield; seed nutritional quality improvement. Biopesticides and Biofertilizers.  03 Hrs

UNIT-II
Transgenic animals: Production of transgenic mice, sheep, and fish; biotechnological approaches for the management of pests; mosquitoes and nematodes; diagnosis of shrimp and fish diseases caused by bacterial, fungal and viral pathogens using molecular methods; livestock improvement.  04 Hrs

UNIT-III
Medical and environmental biotechnology: Human health care products from recombinant DNA technology; disease diagnosis; Strategies of vaccine development. Gene therapy and DNA finger printing. Control of environmental pollution. Bioremediation. Biomass and energy production. Biofuels.  04 Hrs

UNIT-IV
Industrial Biotechnology: Types of fermentation process and Bioreactor design; microbial strain improvement techniques; Bioprocessing technology; downstream processing; production of single cell proteins; immobilization of enzymes and whole cells and their applications. Biosensors.  04 Hrs

PRACTICALS:
1. Perform of ethanolic fermentation using Baker’s yeast
2. Study of a plant part infected with a microbe
3. To perform quantitative estimation of residual chlorine in water samples
4. Isolation and analysis of DNA from minimal available biological samples
5. Case studies on Bioethics (any two)

BOOKS RECOMMENDED:
01. Recombinant DNA technology by Watson et. al., (Scientific American Books).
02. Principles of Gene Manipulation by Old and Primrose. (Blackwell).
03. Concepts in Biotechnology by Balasubrahmanian et. al., (University press).
04. Microbiology by Prescott.
DSEBTT.1. Plant & Animal Biotechnology 60 hrs

Part A. Plant Biotechnology 12 hrs

Unit 1.
1.1 Historical perspectives of plant tissue culture, and Basic requirement for tissue culture laboratory
1.2 Culture mediums for plant tissue culture- MS medium, B5 Medium, WPM medium and plant growth regulators and differentiation.
1.3 Sterilization of media-steam, dry and filter sterilization- Explants sterilization
1.4 Method of tissue culture-formulation of medium explants collection, surface sterilization, inoculation. 1.5 Callus induction, subculture and regeneration of plants
1.6 Suspension cultures- growth and subculture, types and synchronization of suspension cultures.

Unit 2 18 hrs
2.1 Meristem culture and its uses in production of virus free plants
2.2. Clonal propagation, Micro propagation of plants – medicinal plants and endangered plants – method and advantages
2.3. Culture of plant cells for the extraction of secondary metabolites- alkaloid, flavones, pharmaceutical products
2.4. Another culture and production of androgenic haploids.
2.5. Somaclonal variations: Sources of somaclonal variations, selection of somaclones, progeny testing of somaclones, applications of somaclonal variations to crop improvement, Embryo rescue
2.6 Protoplast – Isolation (mechanical and enzymatic methods), Culturing and regeneration of protoplasts Different methods of protoplast fusion (mechanical fusion, chemo fusion, electro fusion).
2.7 Artificial seeds – production, applications and limitations.
2.8 Genetic engineering in plants: Use of Agrobacterium tumefaciens and A. rhizogenes, Ti plasmids, Strategies for gene transfer to plant cells, Direct DNA transfer methods in plants, Gene targeting in plants, Use of plant viruses as episomal expression vectors.
2.9 Nitrogen fixation, Role of Nif nod & Hup genes in nitrogen fixation.

Part B. Animal Biotechnology 12 hrs

Unit 3
3.1 Introduction to animal tissue culture, Tissue culture technique & its applications
3.2 Gene transfer methods in Animals: Microinjection & Retrovirus.
3.3 Introduction to Stem Cell Technology and its applications.
3.4 Introduction to transgenesis, Genetic engineering in animals, Production and applications of transgenic mice, role of ES cells in cloning.
3.5 Growth factors-promoting proliferation of animal cells EGF, FGF, PDGF, IL-I, II-2, NGF and Erythropoietin.

Unit 4 18 hrs
4.1 Animal diseases need help of Biotechnology: Foot-and mouth disease, Coccidiosis, Trypanosomiasis, Theileriosis.
4.2 Hybridoma technology, HAT selection & Production of monoclonal antibodies.
4.3 Genetic engineering in animals for valuable products (vaccines, growth hormones)
4.4 Animal propagation – Artificial insemination, Animal Clones (Dolly). IVF & ET technique, Embryo sexing.

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4.5 Gene therapy: Types & Methods. Vectors in gene therapy,
4.6 Applications of transgenic animals in milk production, meat production and aquaculture
4.7 Transgenic technology for development of animals as bioreactors
4.8 Ethical considerations for transgenic animals

PRACTICALS
1. Sterilization techniques in tissue culture: Glass ware sterilization, Media sterilization, Laboratory sterilization etc.
2. Isolation of cells from Chicken Liver
3. Isolation of total DNA from plant tissue (coconut endosperm)
4. Preparation of simple growth nutrient medium, full strength, half strength, solid and liquid.
5. Preparation of complex nutrient medium (Murashige & Skoog’s medium).
6. Perform plant tissue culture technique for selection of somaclones
7. Preparation of Hanks Balanced salt solution
8. Preparation of Minimal Essential Growth medium
9. Isolation of lymphocytes for culture
10. Isolation of DNA from animal tissue (cattle liver)
11. Resolving DNA on Agarose Gel.
12. Preparation of hybrid cells by hybridoma technology

Recommended books

Plant Biotechnology
1. Plant Tissue Culture and Practice. By Bhojwani, S.S. and Razdan

Animal Biotechnology
1. Lasley JF. Genetics of Livestock Improvement
5. Turner HN & Young SSY. Quantitative Genetics in Sheep Breeding. MacMillan
6. Van Vleck LD, Pollak EJ & Blitenacu EAB. Genetics for Animal Sciences. WH Freeman
7. Crawford RD. Poultry Breeding and Genetics. Elsevier

<table>
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<tr>
<th>VI semester</th>
<th>SECBTT-3. Industrial Biotechnology</th>
<th>15 Hrs</th>
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**Unit 1.**
1.1 Introduction to industrial Biotechnology, basic principles of fermentation technology
1.2 Screening and isolation of Microorganisms, maintenance of strains, strain improvement (Mutant selection, Recombinant DNA methods).
1.3 Fermentation media: Natural and Synthetic Media
1.4 Sterilization techniques: Physical & Chemical methods 04 Hrs.

**Unit 2.**
2.1 Fermentor design: Process of Aeration, Agitation, Temperature regulation and Foam control.
   Types of Fermentors.
2.2 Type of Fermentation: Solid State, Submerged fermentation and continuous fermentation
2.3 Immobilized enzyme and cell bioreactors
2.4 Production of Microbial products: Alcohol, Alcoholic Beverage (Beer), Organic acid (Citric acid), Antibiotic (Penicillin), Amino acids (Glutamic acid), Vitamin (B12)
2.5 Brief account of steroid biotransformation. 05 Hrs

**Unit 3**
3.1 Technique: of mass culture of Algae-Spirulina
3.2 Microbial polysaccharides and polyesters
3.4 Introduction to downstream processing, product recovery and purification.
3.5 Methods of Sewage & Effluent treatment. 06 Hrs

**Practicals**
1. Algal and fungal Culture-Spiraling, Agarics, Yeast and Aspergillums.
2. Estimation of citric acid from Aspergillums Culture.
3. Immobilization of Yeast cells.
4. Preparation of wine.
5. Immobilization of enzymes- (Inverses can be obtained from yeast cells and observed for production).
6. Production and analysis of ethanol by Specific gravity method.
7. Production and analysis of amylase.
8. Production and analysis of lactic acid.
9. Isolation of industrially important microorganism from natural resource.

**Recommended books**

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5. Industrial Microbiology. By Prescott & Dum, Agrabios (India) Publishers
   Panima Publishers corp.

SECBTT-4. Bioinformatics 15 Hrs

Unit I Introduction to bioinformatics and data generation
What is bioinformatics and its relation with molecular biology. Examples of related tools (FASTA,
BLAST, BLAT, RASMOL), databases (GENBANK, Pubmed, PDB) and software (RASMOL,
Ligand Explorer).

Unit II Biological Database and its Types 04 Hrs
Introduction to data types and Source. Population and sample,
Classification and Presentation of Data. Quality of data, private and public data sources.
General Introduction of Biological Databases;
   Nucleic acid databases (NCBI, DDBJ, and EMBL).
   Protein databases (Primary, Composite, and Secondary).
   Specialized Genome databases: (SGD, TIGR, and ACeDB).
   Structure databases (CATH, SCOP, and PDBsum)

Unit III Data storage and retrieval and Interoperability 03Hrs
Flat files, relational, object oriented databases and controlled vocabularies. File Format
(Genbank, DDBJ, FASTA, PDB, SwissProt).
General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE.

Unit IV Sequence Alignments and Visualization 05Hrs
Introduction to Sequences, alignments and Dynamic Programming; Local alignment and Global
alignment (algorithm and example),
Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W
algorithm).
Methods for presenting large quantities of biological data: sequence viewers (Artemis, SeqVISTA),
3D structure viewers (Rasmol, SPDBv, Chime, Cn3D, PyMol), Anatomical visualization.

Practicals:
1. Biological databases and organization- Searching Pub Med, Introduction to NCBI, NCBI data bases,
   EMBL, DDBJ.
2. Sequence alignments- BLAST, FASTA, Clustal W, Sequence manipulation Suite.
3. Phylogenetic analysis- PHYLIP and Tree view
4. Primer designing- Oligo and Primer3

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\text{Gulbarga University, Kalaburagi.}
VI semester
DSEBTT-2. Project work

It is based on any papers of biotechnology from 1st to VI semester which may be field or laboratory based research work. The work of this project should cover minimum of three months and maximum of six-month duration. Every student should perform their individual project work under the supervision of subject teaching staff.
GULBARGA UNIVERSITY, KALABURAGI
B.Sc ----- Semester Degree Theory Examination in Biotechnology,
Paper:

Time: 3 h  
Max.Marks: 80

Instruction to Candidates:  
1. Answer all the questions.  
2. Draw diagrams wherever necessary

I. Answer any TEN of the followings in two or three sentences  
(2x10=20)

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 
10. 
11. 
12.

II. Answer any FOUR of the followings in brief  
(4x5=20)

13. 
14. 
15. 
16. 
17. 
18.

III. Answer any FOUR of the followings  
(4x10=40)

19. 
20. 
21. 
22. 
23. 
24.
Model Question paper for internal theory examination for Core and DSE papers:

GULBARGA UNIVERSITY, KALABURAGI
B.Sc ----- Semester Degree Theory Internal Examination in Biotechnology

Paper:

Time: 1 h

Max. Marks: 20

I. Answer the followings in two or three sentences
   1.
   2.
   3.
   4.
   5.

II. Answer any ONE of the followings in brief
    6.
    7

III. Answer any ONE of the followings
    8.
    9.

Model Question Paper for SEC theory examination:

GULBARGA UNIVERSITY, KALABURAGI
B.Sc ----- Semester Degree Theory Examination in Biotechnology

Paper:

Time: 2 h

Max. Marks: 40

Instruction to Candidates: 1. Answer all the questions.
                           2. Draw diagrams wherever necessary

I. Answer any FIVE of the followings in two or three sentences
   1.
   2.
   3.
   4.
   5.
   6.

II. Answer any TWO of the followings in brief
    13.
    14.

[Signature]

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III. Answer any TWO of the followings

(2x10=20)

19
20
21

NOTE: For SCE paper there will not be internal theory examination. Instead the candidate shall submit the report on the practical carried out during the semester for TEN marks.

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B.Sc. I. SEMESTER BIOTECHNOLOGY PRACTICAL EXAMINATION MODEL PAPER

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<th>Time: 3h</th>
<th>Paper No.</th>
<th>Max. Marks: 40</th>
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<tbody>
<tr>
<td>1. <strong>Perform</strong> Major Experiment</td>
<td>12</td>
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<td>2. <strong>Perform</strong> Minor Experiment</td>
<td>08</td>
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<tr>
<td>3. <strong>Identify and Comment on A, B, C, D, E</strong></td>
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<tr>
<td>4. <strong>Records</strong></td>
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</tbody>
</table>

Total Marks: 40

Chairman BOS
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