

KANNUR UNIVERSITY

(Abstract)

B.Sc Microbiology-Scheme & syllabus of Core/Complementary/Open/Common Courses under Choice Based Credit Semester System for Under Graduate Programme- implemented with effect from 2009 admission-Orders Issued.

ACADEMIC BRANCH

No.Acad/C2/8964/2008

Dated, K.U.Campus. P.O,12- 07-2009.

- Read: 1.Minutes of the meeting of the Board of Studies in Microbiology held on 28.05.2009.
2. Minutes of the meeting of the Faculty of Science held on 16-06-2009.
3. U.O No.Acad/C2/3838/2008 (i) dated 07-07-2009.
4. Letter from the Chairman, BOS Microbiology (Cd).

ORDER

1. The Board of Studies in Microbiology (Cd) vide paper read (1) above has prepared and finalised the Scheme and Syllabus of Microbiology Core/Complementary/Open/Common Courses under Choice Based Credit Semester System for implementation from 2009 admission.

2. The recommendations of the Board in restructuring the syllabus is considered by the Faculty of Science vide paper read (2) and recommended for the approval of the Academic Council.

3. The Regulations for Choice based Credit Semester System is implemented in this University vide paper read (3).

4. The Chairman, BOS in Microbiology (Cd) vide paper read (4) forwarded the restructured scheme and syllabus of Microbiology Core/Complementary/Open/Common Courses under Choice Based Credit Semester System, prepared by the Board of Studies in Microbiology (Cd) for implementation with effect from 2009 admission.

5. The Vice Chancellor, after examining the matter in detail, and in exercise of the powers of the Academic Council as per section 11(1) of Kannur University Act 1996 and all other enabling provisions read together with, has accorded sanction to implement the scheme and syllabus of Microbiology Core/Complementary/Open/Common Courses restructured in line with Choice Based Credit Semester System, with effect from 2009 admission, subject to ratification by the Academic Council.

6. The restructured scheme and syllabus of Core/Complementary/Open/Common Courses under Microbiology Programme restructured in line with Choice Based Credit Semester System, implemented with effect from 2009 admission is appended.

7. The Scheme and Syllabus of Complementary Courses offered for this Programme will be available along with the syllabus of Core Courses of the Complementary subject.

8. The affiliated Colleges are not permitted to offer Complementary Courses in violation to the provisional/permanent affiliation granted by the University. Changes in Complementary Courses are permitted with prior sanction /revision in the affiliation order already issued in this regard.

9. If there is any inconsistency between the Regulations for CCSS and its application to the Scheme & Syllabus prepared, the former shall prevail.

10. Orders are issued accordingly.

To: Sd/-
REGISTRAR

1. The Principals of Colleges offering Microbiology Programme
2. The Examination Branch (through PA to CE)

Copy To:

1. The Chairman, BOS Microbiology (Cd)
2. PS to VC/PA to PVC/PA to Regr
3. DR/AR I Academic
4. Central Library
5. SF/DF/FC.

Forwarded/By Order

SECTION OFFICER



KANNUR UNIVERSITY

Course Structure and Syllabus

FOR

UNDERGRADUATE PROGRAMME

IN

MICROBIOLOGY

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Course Structure

B.Sc Microbiology

SEMESTER 1

No	Title of the Course	Hours /week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (English)	4	3	3
3	Common Course (Additional Language)	5	4	3
4	Core Course 1	3	4	3
5	Complementary 1 (Course I)	4	3	3
6	Complementary 2 (Course I)	4	3	3

SEMESTER 2

No	Title of the Course	Hours/week	Credits	Exam hrs
1	Common Course (English)	5	4	3
2	Common Course (English)	4	3	3
3	Common Course (Additional Language)	5	4	3
4	Core Course 2	3	4	3
5	Complementary 1 (Course II)	4	3	3
6	Complementary 2 (Course II)	4	3	3

SEMESTER 3

No	Title of the Course	Hours/week	Credits	Exam hrs
1	Common Course (General)	5	4	3
2	Common Course (General)	5	4	3
3	Core Course 3	3	4	3
4	Core Course 4	2	3	3
5	Complementary 1 (Course III)	5	3	3
6	Complementary 2 (Course III)	5	3	3

SEMESTER 4

No	Title of the Course	Hours/week	Credits	Exam hrs
1	Common Course (General)	5	4	3
2	Common Course (General)	5	4	3
3	Core Course 5	2	4	3
4	Core Course 6	3	4	3
5	Complementary 1 (Course IV)	5	3	3
6	Complementary 2 (Course IV)	5	3	3

SEMESTER 5

No	Title of the Course	Hours / week	Credit	Exam hrs
1	Open Course 1	2	2	3
2	Core Course 7	5	4	3
3	Core Course 8	5	4	3
4	Core Course 9	4	3	3
5	Core Course 10	9	6	3

SEMESTER 6

No	Title of the Course	Hours / week	Credit	Exam hrs
1	Open Course 2	2	2	3
2	Core Course 11	5	4	3
3	Core Course 12	5	4	3
4	Core Course 13	10	6	3

The Hour/Credit distribution for Complementary Theory/Practical examination shall be decided by the Board of Studies concerned.

The following Courses are offered as Common Courses (General) for III and IV Semesters:

1.3A01MCB Biochemistry I

2.3A02MCB General Microbiology

3.4A03MCB Biochemistry II

4.4A04MCB Methods in Microbiology

Scheme Core (Microbiology)

Syllabus for Course 5B09MCB will be framed and communicated later.

Scheme Microbiology(Complementary)					
No	Semester	Course	Title of the course	Hours/	Credit

No.	Semester	Course Code	Title of the course	Hours/ week	Credit
1	I	1B01 MCB	Methodology and Perspective of Science	3	4
2	II	2B02 MCB	Biophysics and Bioinformatics	3	4
3	III	3A01 MCB	Biochemistry I	5	4
4	III	3A02 MCB	General Microbiology	5	4
5	III	3B03 MCB	Microbiology Practical I	3	4
6	III	3B04 MCB	Microbial Physiology	2	3
7	IV	4A03 MCB	Biochemistry II	5	4
8	IV	4A04 MCB	Methods in Microbiology	5	4
9	IV	4B05 MCB	Microbial Taxonomy	2	4
10	IV	4B06 MCB	Microbiology Practical II	3	4
11	V	5B07 MCB	Microbial Genetics	5	4
12	V	5B08 MCB	Food and Agricultural Microbiology	5	4
13	V	5B09 MCB	Environmental & Sanitation Microbiology	4	3
14	V	5B10 MCB	Microbiology Practical – III	9	6
15	VI	6B11 MCB	Immunology	5	4
16	VI	6B12 MCB	Medical Microbiology	5	4
17	VI	6B13 MCB	Microbiology Practical – IV	10	6

		Code		week	
1	I	1C01 MCB	Basic Microbiology I	2	2
2	I	1C05 MCB	Microbiology-Comp Practical	2	*
3	II	2C02 MCB	Basic Microbiology II	2	2
4	II	2C05 MCB	Microbiology-Comp Practical	2	*
5	III	3C03 MCB	Basic Microbiology III	2	2
6	III	3C05 MCB	Microbiology-Comp Practical	3	*
7	IV	4C04 MCB	Basic Microbiology IV	2	2
8	IV	4C05 MCB	Microbiology-Comp Practical	3	4

**The Project work shall be Laboratory/field based on research/survey in groups of 2/3 students and Project report shall be one for one group.*

Scheme Open Courses					
No	Semester	Course Code	Title of the course	Hours/week	Credit
1	V	5D01 MCB	Molecular biology	2	2
2	V	5D02 MCB	Genetic Engineering	2	2
3	VI	6D01 MCB	Microbial Biotechnology	2	2
4	VI	6D02 MCB	Project Work*	2	2

1B01 MCB METHODOLOGY AND PERSPECTIVE OF SCIENCE

Hours/Week- 3

Credits- 4

Module I : Science and Science Studies

Types of knowledge: Practical, theoretical and scientific knowledge, Information:

What is science? What is not science? Laws of Science, Basis for scientific laws and factual truths.

Science as a human activity, scientific temper, empiricism, vocabulary of science, science disciplines.

Revolutions in science, Science and Technology.

Module II : Methods and Tools of Science

Hypotheses: theories and laws in science, Observations, evidences and proofs. Peer reviews.

Posing a question; formulation of hypothesis; Hypothetico-deductive model, Inductive model. Significance of verification (proving), corroboration and falsification (disproving), auxiliary hypothesis, adhoc hypothesis.

Revision of scientific theories and laws.

Importance of models, simulations and virtual testing. Mathematical methods versus Scientific methods.

****Module III :**

Module IV : Data handling in ethics science

Documentation of experiments. Nature and Types of data – typical examples; Data acquisition; Treatment of data; Data interpretation, Significance of statistical tools in data interpretation, errors and inaccuracies, instrumental errors and variables, human errors (basic idea).

Data presentation: graphs, tables, histograms and pi diagrams.

Statistical testing of hypothesis, null hypothesis, Significance test – Statistics based acceptance or rejection of a hypothesis. Deduction of scientific correlation, patterns and trends.

Ethics in Science: Scientific information, Depositories of scientific information, primary, secondary and digital sources, Sharing of knowledge; transparency and honesty; danger of preconceived ideas.

Reporting of observational and experimental data, human bias, Biased observations, Influence of observer on observations, using and acknowledge observations by others. Publications and Patents. Plagiarism.

Reference Books

Gieryn, T.f. Cultural Boundaries of Science., Univ. Chicago Press, 1999.

Collins H. and T. Pinch. The Golem: What Everyone should know about Science ., Cambridge Univ Press, 1993

Hewitt, Paul G, Suzanne Lyons, John a. Suchocki-Wesley, 2007

Newton R G. The Truth of Science: New Delhi, 2nd edition Bass, Joel, E and et. Al, Methods for Teaching Science as Inquiry, Allyn & Bacon, 2009.

**** The Syllabus for Module III will be framed and communicated later.**

2B02 MCB BIOPHYSICS AND BIOINFORMATICS

Hours/Week- 3

Credits- 4

Module I: Introduction to biophysics, its importance in modern biology, Hydrogen bond and water structure, Importance of hydrogen bond in biological systems, pH.

Module II : Surface tension, adsorption, osmosis, dialysis and colloids - definition brief discussion and their importance in biological systems.

Module III: Structural hierarchy of proteins, Secondary structure - α and π helices, β plated sheets, Omega loops, Irregular and random structures in proteins.

Module IV: Structural hierarchy of nucleic acids A, B, Z DNA and their inter conversions, Watson and Crick base pairing, Hoogsteen base pairing, Triple and quadruple helical structures in nucleic acids, DNA super coiling, DNA protein assemblies, t RNA structure, Ribosomes

Module V: Conformation of oligo and polysaccharides, Their conjugate forms with proteins and lipids

Module VI : The structure of biological membranes, Modern membrane theories, the Singer - Nicolson, "fluid-mosaic" membrane model, The transport processes through biological membranes. Membrane as a selective barrier for different substances, the contribution of lipid bilayer and membrane proteins (channels and transporters) to the biological transport processes. Active and passive forms of the membrane transport. Diffusion as the main way of passive transport.

Module VII : Osmosis and osmotic pressure, The role of osmosis in cell volume regulation. The iso, hypo, and hypertonic solutions, their influence on the cell. Ionic diffusion. Active and passive bioelectric properties of membranes.

Module VIII: Introduction to bioinformatics, Basic concepts of computing machines, Classification of biological databases, Biological data formats, application of bioinformatics in various fields. Data retrieval-Entrez and SRS.

Module IX: Introduction to Sequence alignment, Local and Global alignment concepts, Multiple sequence alignment - Progressive alignment, Database searches for homologous sequences - Fasta and Blast, Evolutionary analysis in bioinformatics, Secondary structure prediction, A brief introduction of genomics & proteomics. Drug - receptor interactions molecular modeling, drug designing, docking

References:

- | | | |
|--------------------------|---|---------------------|
| 1) Biophysics | - | K.Roy |
| 2) Biological chemistry | - | G.P.Talwar. |
| 3) Biophysical chemistry | - | Cantor and Schimmel |
| 4) Bioinformatics | - | Mani and Vijayaraj |

3A01 MCB BIOCHEMISTRY I

Hours/Week- 5

Credits- 4

Module I Origin of life. Prokaryots, Eukaryotes. Chemical bonds, van der Waal's forces, Properties of water. Acids, bases and buffers, pH and its measurement, making of buffer solutions, 1st and 2nd laws of thermodynamics. Their significance to 'living'

Module II: Chemical Reactions: Red-ox reactions, redox potentials and their role in living system, molarity, molality and normality of solutions and their measurement, expressions for concentrations.

Module III : Basic organic chemistry: Chirality of biomolecules, D/d and L/l forms, reactions of -OH and -CHO and carbonyl groups. Hydrocarbons: alkenes and polyenes and their reactions.

Classification of reactions. Aldehydes and ketones. Reactions of carbonyl group. Hydrophilic and hydrophobic groups in biological molecules.

Module IV: Amino acids and proteins. Their classification primary structure of proteins. Secondary structure of proteins, tertiary structure and quaternary structure of proteins, Fibrous proteins globular proteins. Conjugate proteins. Protein nutrition.

Module V: Monosaccharides, oligosaccharides and poly saccharides molecular conjugates with oligo and poly saccharides.

Module VI : Fats and fatty acids, Lipid classification properties of lipid aggregates, Biological membranes. Conjugate forms of lipids. Lipid nutrition. Lipid digestion and absorption. Fatty acid oxidation. Fatty acid biosynthesis.

Module VII: Classification of biomolecules based on their role in bioprocesses. Molecules involved in information storage and retrieval. Signals and signal transduction and molecules involved.

Module VIII: Biomolecular perspective: repeating units in biomolecules, bending, looping, pleats, salt bridges and their determinants. Basis for biomolecular interactions, enzyme-substrate, antigen-antibody recognition.

References

- 1) Principles of Biochemistry - Lehninger
- 2) Outlines of Biochemistry - Conn & Stumpf
- 3) Text book of Biochemistry - West, Todd et al.
- 4) Biochemistry - Voet and Voet

3A02 MCB GENERAL MICROBIOLOGY

Hours/Week- 5

Credits- 4

Module I- The Historical Development of Microbiology, Spontaneous generation versus biogenesis, Germ theory of diseases, pure-culture concept. Microscopy: Bright field, Dark field, Phase contrast and Fluorescence microscope. Electron microscope-transmission and scanning. Specimen preparation for electron microscope

Module II- Morphology of bacteria - Size, shape, Arrangement. Ultra structure of Prokaryotic cells Flagella, Pili, Glycocalyx, cell wall. Mechanism of Gram stain, Cytoplasmic membrane, Protoplasts, Spheroplast internal structures like, ribosome, volutine granules, vacuole, nuclear material, intracellular membrane system. Dormant forms of Prokaryotic microorganisms - spores and cysts.

Module III- Gross Morphological characteristics of Eukaryotic Microorganisms - Morphology of fungi, Algae and Protozoa - brief account. Comparative account of ultra structure of Eukaryotic cell with prokaryotic cells; Flagella and Cilia, Cytoplasmic membrane, Nucleus, Endo-plasmic reticulum, Golgi complex, chloroplast, spores and cysts of Eukaryotic microorganisms.

Module IV- Nutritional requirements for microbial growth. Culture media -Chemical elements as nutrients. Carbon, Nitrogen Hydrogen, Oxygen, Sulfur, Phosphorus and other trace elements definitions of Chemo autotrophs, Chemoheterotrophs, Photo autotrophs, Photo heterotrophs. Media for cultivation of bacteria, fungi, protozoa and algae, Tissue culture media, brief account of animal cell culture, Plant cell culture, Chemically defined media, complex media, Selective media. Differential media, enrichment media and microbiological Assay media.

Module V- Fundamentals of Microbial control, Antimicrobial Agents, Difference between Microbistatic and microbicidal agents. Sterilization and pattern of death in a microbial population, Conditions that affect antimicrobial agents. Mechanism of microbial cell damage. Physical and Chemical agents of microbial control - Heat, filtration, and Irradiation. Different Kinds of chemical antimicrobial agents, Characters of an ideal Chemical agent, Major groups of disinfectants and Antiseptics. Evaluation of antimicrobial potency of disinfectants. Chemical sterilants and their use.

Module VI- Isolation and cultivation of Pure Cultures, streak plate method, spread plate method, Pour plate method, colony forming unit-Enumeration of microbial cells, Preservation of pure cultures Refrigeration, Deep freezing and Freeze drying (Lyophilization).

Reference:

- | | | |
|---|---|------------------|
| 1) Microbiology Concepts and applications | - | Pelzar etal. |
| 2) Essential of Microbiology | - | Purohid and Sing |
| 3) Microbiology | - | Presscot |

3B03 MCB : Microbiology Practical I

Hours/Week- 3

Credits- 3

List of Experiments Suggested

- 1) Cleaning and sterilization of glassware
- 2) Introduction to autoclave, hot air oven, incubator
- 3) Microscope and its maintenance
- 4) Simple staining
- 5) Gram's staining
- 6) Capsule staining
- 7) Spore staining
- 8) Flagella staining
- 9) Preparation of media(Nutrient broth, nutrient agar)

10) Isolation of pure culture (Streak plate method)

3B04 MCB MICROBIAL PHYSIOLOGY

Hours/Week- 2

Credits- 3

Module I: Nutritional types of microorganisms. Nutritional requirements for microbial growth - Carbon, Nitrogen, Sulfur, Oxygen, Phosphorus, Hydrogen, microelements and energy sources; Vitamins and growth factors. Factors influencing microbial growth - Temperature, Gaseous atmosphere, pH, Osmotic pressure and Hydrostatic pressure.

Module II: Reproduction and growth of microorganisms, Kinetics of growth -multiplication, and death of microbial cell. Growth curve in a closed system, continuous culture and synchronous culture. Measurement of population growth.

Module III : Microbial energetics- photosynthesis, light and dark reaction, Role of chlorophyll and bacterial chlorophyll in photosynthesis. Anoxygenic photosynthesis - Purple bacterial photosynthesis - Electron flow and ATP synthesis. Autotrophic Carbon dioxide fixation (Calvin cycle) Chemolithotrophy (energy from oxidation of inorganic electron donors) Hydrogen oxidizing bacteria, Sulfur bacteria, Iron-oxidizing bacteria, Ammonium and Nitrate oxidizing bacteria. ATP Production by chemolithotrophs. Anaerobic respiration, Nitrate reduction and Denitrification process Sulfate reduction, Methanogenesis and Acetogenesis.

Module IV: Fat and phospholipid hydrolysis. Hydrocarbon transformation (Aliphatic and Aromatic

hydrocarbon)

Module V: Nitrogen fixation - Nitrogenase Physiology and genetics. Physiological difference in nitrogen fixing cells (Free living, symbiotic and Associative symbiotic organisms)

References:

1. Microbiology Concepts and Applications - Pelzar et al
2. Brock's Biology of Microorganisms - Madigan Martinko and Parker.
3. Microbiology - Prescott.
4. Microbial Genetics - Frifieldar

4A03 MCB BIOCHEMISTRY II

Hours/Week- 5

Credits- 4

Module I - Principles of bioenergetics: Bioenergetics and thermodynamics - entropy - standard free energy change and equilibrium constant - Phosphate group transfers and ATP- Phosphorylated compounds and thioesters-ATP energizes active transport across the membrane - Biological oxidation -reduction reaction- flow of electrons- dehydrogenation

Module II - Enzymology: Enzymes- general account- classification and nomenclature- co factors and co enzymes-Mechanism of enzyme action -Lock and key model-regulation of the enzyme action- Allosteric inhibition and other inhibitors- ping pong mechanism- mechanism of action of chymotrypsin- Haemoglobin nad myoglobin in enzyme action- enzyme specificity

Module III - Enzyme kinetics: Reaction rate - the Michaelis-Menton equation- types of inhibition and the change in enzyme kinetics with reference to inhibition- single substrate and bi substrate kinetics- random mechanisms- enzyme action versus catalysis- enzymes other than proteins- ribozymes and its possible mechanism of action, Enzymes as research tools — ELISA methods, modification of biological compounds with the help of enzymes

Module IV: Glycolysis- reaction sequence- energy input and output- dehydrogenation - Fermentation

Citric acid cycle: reaction sequence — energy relations - redox potential -dehydrogenase activity- ATP - carboxylase activity- Major enzymes and co enzymes- path of formation of Acetyl CoA- Major intermediary products- α -keto glutamic acid-release of CO₂.

Module V: Oxidative phosphorylation and photophosphorylation- electron carriers- coenzymes- major enzymes- antenna complex- production of ATP- redox potential- cyclic and non cyclic photophosphorylation- pigment systems- electron carriers- assimilatory power- differences and similarities, Oxidation of amino acid and production of Urea, Amino acid synthesis: major biosynthetic pathways-Amino acid catabolism and de novo synthesis

Module VI: Biosynthesis and degradation of major carbohydrates- role of insulin and other hormones- gluconeogenesis, Biosynthesis of nucleotides and its catabolism, Fatty acid biosynthesis and its degradation - cholesterol and other steroid compounds- hormones.

Reference

- 1) Principles of Biochemistry - Lehninger
- 2) Outlines of Biochemistry - Conn & Stumpf
- 3) Text book of Biochemistry - West, Todd et al.
- 4) Biochemistry - Voet and Voet

*** 4A04 MCB Methods in Microbiology**

Hours/Week- 5

Credits- 4

**Syllabus yet to be framed.*

4B05 MCB MICROBIAL TAXONOMY

Hours/Week- 2

Credits- 4

Module I-Classification of Microorganisms - objectives and Practical value of taxonomy. Phylogenetic relationship. Major systems of biological classification. Five kingdom And Three kingdom classification, Scientific nomenclature , Taxonomic hierarchy, Evolutionary relationships among prokaryotic groups. Various criteria used in bacterial classification , Morphological characteristics, staining characters, Biochemical tests, serotyping and DNA hybridization.

Module II Bergey's manual of systematic bacteriology - an international reference book, Eubacteria and Arc haeobacteria. Brief account of differentiating characters of different groups of Gram negative Eubacteria and Gram-positive Eubacteria. Comparative account of important groups of Archaeobacteria.

Module III -Classification of fungi - slime molds, flagellated lower fungi, Terrestrial fungi-brief account with examples. Classification of Algae - Green Algae, Diatoms and Golden brown Algae, Dianoflagellates - brief account with examples. Classification of Protozoa - Flagellates, Amoebas, sporozoa and Ciliates- Brief account with examples.

Module IV:Structure of viruses – a brief general structure - classification of plant animal and bacterial viruses – brief account

Reference:

- | | | |
|---|---|------------------|
| 1) Microbiology Concepts and applications | - | Pelzar etal. |
| 2) Essential of Microbiology | - | Purohid and Sing |
| 3) Microbiology | - | Presscot |

4B06 MCB : Microbiology Practical II

Hours/Week- 3

Credits- 4

List of Experiments Suggested

- 1) Enumeration of microbial ceils (Pour plate method)
- 2) Fungal staining
- 3) Fungal culture
- 4) Determination of phenol coefficient.
- 5) Use of differential and selective media(Mannitol salt agar ,Mac Conkey agar)
- 6) Oligo dynamic action of heavy metals on microbial cell.
7. Effect of temperature on growth of microorganism
8. Influence of PH on growth
9. Bacterial growth curve
10. Isolation of petit mutants of yeast
11. Isolation of bacteriophages from sewage.

5B07 MCB MICROBIAL GENETICS

Hours/Week- 5

Credits- 4

Module I : Importance of microbial genetics - Phenotype, Genotype Mutations and mutants, isolation of mutants. Molecular basis of mutation. Base pair substitution, Point mutation - insertion or deletion – Frame shift mutation. Back mutation, suppressor mutation. Mutagens Chemicals and Radiation.

Module II : Genetic Recombination, conjugation, Transformation, Transduction, Mechanism and applications.

Module III : Bacteriophages; General characteristics, Lysogenic and Lytic phage cycle. Transduction.

Module IV: Plasmids, Types of plasmids, Replication of plasmids. R.Plasmid F Plasmid, Col Plasmid, Degradative plasmids, Metal resistance and pesticide resistance. Transposable elements

Module V: Yeast Genetics: Mating types, Yeast plasmid, mitochondrial inheritance in yeast.

References:

1. Microbiology Concepts and Applications - Pelzar etal
2. Brock's Biology of microorganisms - Madigon Martinko and Parker.
3. Microbiology - Prescott.
4. Microbial Genetics – Frifieldar

5B08 MCB FOOD and AGRICULTURAL MICROBIOLOGY

Hours/Week- 5

Credits- 4

Module I Scope of food microbiology- food spoilage, food preservation, food safety and fermented food- An overview

Module II Factors affecting the growth and survival of microorganisms in food. Nutrient content, pH and buffering capacity, Redox potential, inhibitory substances and anti-microbial barriers, water activity. Environmental factors- RH, temperature, gaseous atmosphere.

Module III Microorganisms important in food microbiology- bacteria, molds and yeasts-morphology, culture characteristic and physiology of these microorganisms. Sources of contaminants of food-animals, plants, soil, air, waste water (sewage)., contamination during handling and processing.

Module IV General principles underlying spoilage of food, chemical changes caused by spoilage: causes of spoilage, classification of food by ease of spoil-age, factors affecting food spoilage, spoilage of milk, meat, fish, cereals, pulses, oil seeds, egg, fruits and vegetables- Brief account.

Module V Principles of food preservation- Asepsis, removal of microorganisms, maintenance of anaerobic conditions, high temperature processing and low temperature storage, drying, food additives and chemicals, irradiation. High pressure processing (Pascalization). Preservation of milk, meat, fish, cereals, pulses, oil seeds, fruits and vegetables.

Module VI Significance of food born diseases, risk factors associated with food born illness. Pathogenesis of diarrheal diseases. Clostridium botulinm, C. Perfringenes, Salmonalla, Staphylococcus and Shigella as examples of food born pathogens.- pathogeneses and clinical features.

Module VII Fermented foods- fermented milk, yoghurt, cheese, wine, soya sauce and other indigenous fermented foods (Idly). Yeast as food and fodder. Single cell proteins - Spirullina. Microbiology of food plant sanitation Hazard analysis critical control point (HACCP) Microbiological standards of food.

Module VIII A brief historical perspective of agricultural microbiology

Module IX Nitrogen fixation and bio-fertilizers- microbial inoculants, definition and importance of microbial inoculants, brief account of production and application of Rhizobium, Azotobacter and Phosphobacteria. Agricultural importance of Azospirillum and Azolla-anabaena system, Mycorrhiza- Brief account of Ectomycorrhizae, entomycorrhizae, ectendomycorrhizae and their importance in agriculture.

Module X Plant pathology- plant pathogenesis-plant disease resistant-Morphological , functional and protoplasmic resistance, variation in disease resistance. Mode of entry of pathogens and disease symptoms, physiology of parasitism, factors affecting disease incidences and a brief account of control measures. Phytophthora diseases- Brief account. General account of important fungal, bacterial and viral diseases.

References:

- 1) Text book of Agricultural Microbiology - G. Rangaswami, D.J Bhagyaraj
- 2) Soil Microorganisms and plant growth - Subba Rao
- 3) Food microbiology - Adams & Moss
- 4) Food Microbiology - Frazier et-al
- 5) Modern Food Microbiology - Jay et-al.

***5B09 MCB ENVIRONMENTAL& SANITATION MICROBIOLOGY**

Hours/Week- 4

Credits- 3

**Syllabus yet to be framed.*

5B10 MCB : Microbiology Practical III

Hours/Week- 9

Credits- 6

List of Experiments Suggested

1. Demonstration of mitosis and meiosis
2. Extraction and estimation of DNA
3. Extraction and estimation of RNA
4. b -Galactosidase induction.
5. Demonstration of Polyteen chromosomes
6. Aerobic mesophilic count of fish samples and milk
7. Isolation of constituent flora of fermented milk
8. Production of wine.
10. Methelyneblue reductase test.
11. Isolation of Rhizobium and Azotobacter.
12. Ammonification and nitrification of organic compounds using *Proteus vulgaris*
13. Examination of microflora of soil
14. Study of antibiosis by soil microorganism, determination of antimicrobial spectrum

6B11 MCB IMMUNOLOGY

Hours/Week- 5

Credits- 4

Module I:Infection: Different types like primary, secondary, cross, nosocomial, endogenous, exogenous etc. Definitions. Different sources of infections methods of transmission of diseases. Carriers-different types. MID, ID₅₀,MLD, LD 50. Bacteremia, septicemia, virulence factors of microorganism.

Module II: Immunity: Different types- innate, acquired, active and passive. Mechanisms of immunity- Barriers, phagocytosis, inflammation. Immune responses-primary and secondary-Functions of immune systems- different organs and cells of immune system. central and peripheral lymphoid organs, leucocytes, lymphocytes-T and B Cells macrophages, plasma cells.

Module III: Antigens-Different types. Haptens, antigenic determinants-definitions. Immunoglobulins- basic structure and different classes-IgG, IgA, IgM, IgD and IgE. Their functions. Theories of anti bodies synthesis-instructive and selection theory, clonal selection theory.Monoclonal anti bodies. Antigen anti body reactions - precipitation, agglutination, compliment fixation, ELISA immunofluorescence, RIA, Clinical applications of the antigen antibody reactions-widal test, VDRL test, Wassermann CFT, RA-Latex agglutination test, Elisa for HIV.

Module IV: Hypersensitivity-different types and mechanisms. Autoimmunity-different autoimmune diseases like pernicious anemia and rheumatoid arthritis. Transplantation and tumor immunity - A brief account.

References:

- | | | |
|------------------------------------|---|---|
| Mycology Text book of Microbiology | - | Dr.R.Ananthanarayanan and Dr.C.K. Jayaram Paniker |
| Essential Immunology | - | Ivan M Roitt |
| Medical Microbiology | - | Mackie and Mac Artney's Vol.II |
| Fundamentals in Immunology. | - | Colmen |
| Immunology | - | Janis Kuby |

6B12 MCB MEDICAL MICROBIOLOGY

Hours/Week- 5

Credits- 4

Module I: Morphology, cultivation, metabolic characters, resistance, symptoms, epidemiology, laboratory diagnosis, prophylaxis and treatment of the diseases caused by – Staphylococcus aureus, Streptococcus Pyogenes, Streptococcus pneumonia, Neisseria gonorrhoea

Module II: Morphology, cultivation, metabolic characters, resistance, symptoms, epidemiology, laboratory diagnosis, prophylaxis and treatment of the diseases caused by – Bacillus anthracis, Corynebacterium diphtheriae, Clostridium tetani, Clostridium botulinum, Clostridium welchii

Module III: Morphology, cultivation, metabolic characters, resistance, symptoms, epidemiology, laboratory diagnosis, prophylaxis and treatment of the diseases caused by diseases caused by – Klebsiella, E.coli, Salmonella, Shigella

Module IV: Morphology, cultivation, metabolic characters, resistance, symptoms, epidemiology, laboratory diagnosis, prophylaxis and treatment of the diseases caused by Campylobacter, Helicobacter, Haemophilus, Bordetella, Brucella, Yersinia pestis, Vibrio cholerae.

Module V: Morphology, cultivation, metabolic characters, resistance, symptoms, epidemiology, laboratory diagnosis, prophylaxis and treatment of the diseases caused by Mycobacterium tuberculosis, Mycobacterium leprae.

Module VI: Morphology, cultivation, metabolic characters, resistance, symptoms, epidemiology, laboratory diagnosis, prophylaxis and treatment of the diseases caused by – Spirochetes – Treponema, Borrelia and Leptospira Rickettsia

Module VII: Morphology, cultivation, metabolic characters, resistance, symptoms, epidemiology, laboratory diagnosis, prophylaxis and treatment of the diseases caused by – Mycoplasma, Ureaplasma, Chlamydia and Actinomyces.

Module VIII: Viral diseases caused by the following viruses, Herpes viruses (Chicken pox) Paramyxoviruses (Mumps, Measles) Rubella, Hepatitis viruses type A,B,C,D and E, Rhabdovirus (Rabies), HIV, Poliovirus, arboviruses and oncogenic viruses.

Module IX: Human diseases caused by Candida (opportunistic infections in immunocompromised hosts), Aspergillus (*Aspergillus fumigatus*, *Aspergillus flavus*, *Aspergillus clavatus*), Cryptococcus (*Cryptococcus neoformans*, *Cryptococcus laurentii*, *Cryptococcus albidus*, *Cryptococcus gattii*), Histoplasma (*Histoplasma capsulatum*), Pneumocystis (*Pneumocystis jirovecii*), Stachybotrys (*Stachybotrys chartarum*)

References:

Text book of Microbiology – Dr. R. Ananthanarayanan and Dr. Jayaram Panicker.

Medical Microbiology – Mackie and Mac Artney's Vol II

6B13 MCB Microbiology Practical IV

Hours/Week- 10

Credits- 6

List of Experiments Suggested

1. Determination of water quality (Presumptive, confirmed, completed tests)
2. Determination of B.O.D of water
3. Air sampling
4. Differential count of leucocytes
5. Lymphocyte isolation
6. Blood grouping
7. Widal tube agglutination test
8. A S O latex agglutination test.
9. R A latex agglutination test.
10. H Bs Ag latex agglutination test,
11. RPR test.
17. AFB staining
18. Biochemical reactions for identification of various groups of bacteria
19. Identification of bacterial isolates from clinical samples
20. Antibiotic sensitivity test

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KANNUR UNIVERSITY

*Course Structure
and
Syllabus*

FOR

MICROBIOLOGY

(COMPLEMENTARY)

UNDER

CHOICE BASED CREDIT SEMESTER SYSTEM

w.e.f 2009 ADMISSION

Scheme Microbiology(Complementary)					
No	Semester	Course Code	Title of the course	Hours/ week	Credit
1	I	1C01 MCB	Basic Microbiology I	2	2
2	I	1C05 MCB	Microbiology-Comp Practical	2	
3	II	2C02 MCB	Basic Microbiology II	2	2
4	II	2C05 MCB	Microbiology-Comp Practical	2	-
5	III	3C03 MCB	Basic Microbiology III	2	2
6	III	3C05 MCB	Microbiology-Comp Practical	3	-
7	IV	4C04 MCB	Basic Microbiology IV	2	2
8	IV	4C05 MCB	Microbiology-Comp Practical	3	4

1C01 MCB Basic Microbiology I

Hours/Week- 2

Credits- 2

Module I:Introductory Microbiology: History, biogenesis Vs abiogenesis, Germ theory of diseases, Koch's postulates, antiseptics, immunization and chemotherapy. The concept of sterilization, methods of sterilization (dry heat, wet heat, radiation, chemical methods and filtration).

Module II:The concept of nutrition. Preparation of media, eg: nutrient agar, nutrient broth, PDA, EMB etc. Concept of microbial species and strains.

Module III:The five kingdom classification: Kingdom Monera, Protista, Fungi, Plantae and Animalia with special reference to microbes, classification of bacteria, cyanobacteria, numerical taxonomy, staining features and simple tests for biochemical characterization

References :

- Campbell, R. **Plant Microbiology**, ELBS, Edward Arnold.
Eugene Rosenburg and Irun R Kohr **Microbial Biology**, Holt Saunders, Japan.
Brock, T.D. **Biology of Microorganism**, Prentice Hall, Englewood
Salle, A.J. **Fundamental Principles of Bacteriology**
Pelczar, Reid and Chan. **Elements of Microbiology**, Mc Graw Hill
Nair, M.C. and S.Balakrishnan. **Beneficial fungi and their utilization**, Scientific Publishers, Jodhpur.
Stapler, D.G. **An introduction to microbiology**, Mc Millan, London.
Somani et al. **Biofertilizers**, Scientific Publisher, Jodhpur.
Somani, L.L. and Bhandari, S.C. **Soil micro organisms and crop growth**. Divya jyothi Prakasan, Jodhpur.
Subha Rao, N.S. **Soil micro organisms and Plant growth**. Oxford IBH, NewDelhi.
Subha Rao, N.S. **Biofertilisers in Agriculture**, Oxford and IBH, NewDelhi.
Hill, I.R. and Wright, S.J.L. **Pesticide Microbiology**, Academic Press, London.
Chawla, O.P. **Advances in Biogas technology**, ICAR, NewDelhi.
Principles of fermentation technology - P.F. Standbury, A. Whitaker and S. J. Hall

2C02 MCB Basic Microbiology II

Hours/Week- 2

Credits- 2

Module I:Tools in microbiology: Hand lens, Leuwenhoek and his microscope, principle behind of ocular microscopy, electron microscope, scanning tunneling microscopes and other recent developments.Nature of the microbial cell surface - gram positive and gram negative bacteria- Kinds of flagella- serotypes.

Module II:Prokaryotic cell versus eukaryotic cells. The morphology and ultra structure of bacterial cell wall, flagella and pili, reference to antibiotic penicillin and cell wall growth, bacterial spores (mention only), nuclear material. Microbial growth: Measurement, growth kinetics (mention only)Spontaneous and induced variation arising in microbial population
Gene transfer in microorganisms

Module III:Viruses, phage- culture, Bacteriophage, DNA and RNA phages, T4 phage, Lytic and lysogenic cycles, Host cell adsorption and penetration, synthesis phage nucleic acid. Isolation of pure cultures: spread plate, streak plate, pour plate etc., synthetic media, simple and complex media. Isolation of anaerobes and its culture techniques, slant culture and stab culture.Microbial physiology: Introduction, Microbial growth, measurement, dry weight colony count, total count versus viable count, colorimetric techniques to determine growth.

Module IV:Nutritional classification of microorganisms. The concept of bacterial nutrients, major elements, micro elements and their role, other factors affecting the growth, requirement of carbon, nitrogen, phosphorus and sulphur. Nutrient uptake imbibition, diffusion osmosis, cell facilitated diffusion, role of carrier proteins, active transport, group translocation, symport and antiport.

Module V:Microbial metabolism: Aerobic and anaerobic respiration, glycolysis, Krebs cycle, pentose phosphate pathways, hexose monophosphate shunt, other salvage pathways in purine and pyrimidine biosynthesis peculiar to microbes alone. The urea cycle, sulphur assimilation in microbes.

Module VI:Bacterial heterotrophism: The nitrogen nutrition- Mechanism of bacterial nitrogen fixation. Bacterial photosynthesis. Description of photosynthetic reaction centre and light harvesting pigment. Critical difference with photosynthetic apparatus in plants.

Spore formation: Detailed mechanism with examples. Aerobic and anaerobic spore formers. Bacterial toxins, pathogenesis and virulence.

References

1. Microbiology Concepts and applications - Pelzar etal.
- 2) Essential of Microbiology - Purohid and Sing
- 3) Microbiology - Presscot
- 4) Plant Microbiology - Campbell, R.
- 5) Microbial Biology - Eugene Rosenberg and Irun R Kohr.
- 6) Biology of Micro organisms - Brock, T.D.

3C03 MCB Basic Microbiology III

Hours/Week- 2

Credits- 2

Module I: Food Microbiology : General characteristics of mould - Identification of fungi

associated with food including fruits and vegetables : Mucor, Rhizopus, Thamnidium,

Aspergillus. Penicillium. Trichothecium. Geotrichum, Neurospora, Trichoderma, Cladosporium, Helminthosporium, Alternaria and Stenophyllum.

Yeast and yeast like fungi – General characteristics -Classification and identification of yeasts (Brief account). Yeast of industrial importance -True yeasts and false agents.

Bacteria : Morphological and Physiological characteristics important in food microbiology

Food spoilage : Chemical changes caused by micro organisms - Fitness or unfitness of food for consumption - Causes of spoilage - Factors affecting the growth of micro organisms in food- Chemical changes caused by microorganisms.

Food preservation - General principles - Aseptic, removal, anaerobic conditions. Methods of preservation : (i) Preservation by use of High temperature - Heat resistance of microbes and their spore- Heat treatments -Pasteurisation - Heating at 100°C, Canning. (ii) Preservation by use of low temperature - Common or cellar storage - chilling or cold storage -Freezing or Frozen storage- Response of micro organism to freezing. (iii) Preservation by Drying - Sun drying - Drying by mechanical dryers - Freeze drying - Smoking - Microbiology of dried foods like fruits, Vegetables, eggs and milk. (iv) Preservation by food additives - Organic acids and their salts -Propionates, Benzoates, Sorbates, Acetates, Nitrites and Nitrates, Sugar and Salt, Alcohol, Wood smoke, spices and condiments and antibiotics.

Module II: Industrial microbiology: Food fermentation - Bread leavening - by yeast – by other micro organisms - chemical leavening Brewing : Manufacture of Beer- microbiological aspects. Wine : Kinds of wines , manufacture, microbial spoilage, Distilled liquors. Vinegar : Methods of manufacture - microbial defects - fermented vegetables - Sankrauft - Pickles - Fermented dairy products - Fermented milk , cheese, butter, yoghurt and other milk products - spoilage of milk - Preservation of milk.

References :

Campbell, R. **Plant Microbiology**, ELBS, Edward Arnold.

Eugene Rosenburg and Irun R Kohr **Microbial Biology**, Holt Saunders, Japan.

Brock, T.D. **Biology of Micro organism**, Prentice Hall, Englewood

Salle, A.J. **Fundamental Principles of Bacteriology**

Pelczar, Reid and Chan. **Elements of Microbiology**, Mc Graw Hill

Nair, M.C. and S.Balakrishnan. **Beneficial fungi and their utilization**, ScientificPublishers, Jodhpur.

Stapler, D.G. **An introduction to microbiology**, Mc Millan, London.

Somani et al. **Biofertilizers**, Scientific Publisher, Jodhpur.

Somani, L.L. and Bhandari, S.C. **Soil micro organisms and crop growth**. Divya jyothi Prakasan, Jodhpur.

Subha Rao, N.S. **Soil micro organisms and Plant growth**. Oxford 1BH, NewDclhi.

Subha Rao, N.S. **Biofertilisers in Agriculture**, Oxford and IBH, NewDelhi.

4C04 MCB Basic Microbiology IV

Hours/Week- 2

Credits- 2

Module I: Microbes as Biofertilizers:

Chemically fixed Nitrogen versus Biologically fixed Nitrogen. Mycorrhiza - structure, Nutrition and Physiology - Fungus and Host benefits- Increased uptake of minerals . Vesicular Arbuscular Mycorrhiza (VAM) : occurrence, ecology of VAM in the soil, physiology, Host interaction -Isolation and identification of VAM fungal spores- Orchidaceous mycorrhiza.

Module II: Microbiology of Municipal sewage:

sewage treatment- primary, secondary and tertiary treatments - Industrial effluents - microbes as indicators of waste water -pollution treatment process - septic tank - waste water treatment process -mechanical and biological treatment - trickling filters - inhoff tank - activated sludge process - oxidation ponds - anaerobic sludge digestion.

Module III: Solid waste disposal:

Sanitary land fills - composting - cermicompost - disposal of animal and agricultural wastes - Biogas - organic gas available in India - Gobar gas plant technology - Microbiology of Methane production - Biogas from plant wastes.

Module IV: Soil micro organisms and their interaction with pesticides:

Microbial metabolism of aromatic compounds - microbial decomposition of herbicides, insecticides and fungicides - Effect of pesticides on soil micro organisms.

Module V: Diseases due to micro organisms:

Food and water borne -Viral : Castro enteritis, Infectious hepatitis, Polio myelitis
Bacterial : Cholera, Typhoid fever, Gastro enteritis (Campylobacter jejuni) - Field investigation, Laboratory testing and preventive measures.

References :

- Campbell, R. **Plant Microbiology**, ELBS, Edward Arnold.
Eugene Rosenburg and Irun R Kohr **Microbial Biology**, Holt Saunders, Japan.
Brock, T.D. **Biology of Microorganisma**, Prentice Hall, Englewood
Salle, A.J. **Fundamental Principles of Bacteriology**
Pelczar, Reid and Chan. **Elements of Microbiology**, Mc Graw Hill
Nair, M.C. and S.Balakrishnan. **Beneficial fungi and their utilization**, ScientificPublishers, Jodhpur.
Stapler, D.G. **An introduction to microbiology**, Mc Millan, London.
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Prakasan, Jodhpur.
Subha Rao, N.S. **Soil micro organisms and Plant growth**. Oxford 1BH, NewDelhi.
Subha Rao, N.S. **Biofertilisers in Agriculture**, Oxford and IBH, NewDelhi.

1/2/3/4 C05 MCB Practical

Hours/Week- 9

Credits- 4

1. Use of microscopes - use of equipments and cleaning of glass wares - inoculating loops, needles, petridishes, flasks, culture tubes, pasteur pipettes,
2. Hot air oven, autoclave, incubator, water bath, colony counter, fillers, UV lamp,
3. PH meter, centrifuge, calorimeter, laminar air flow system.
4. Personal hygiene- Microbes from hands, tooth scum and other body parts
5. Isolation of microorganisms from air, water and soil samples. Dilution and pour plating-colony purification
6. Isolation of bacteria
 - a) Pour plate method
 - b) Streak plate method
7. Identification of isolated bacteria-metabolic characterization (1MVIC test)
8. Quantitative estimation of micro organisms
 - a) Total count – Haemocytometer method
 - b) Serial dilution technique
9. Hanging drop motility
10. Growth curve of microorganisms
11. Antibiotic sensitivity of microbes- use of antibiotic discs
12. Testing of water quality
13. Test of antibodies against given bacteria
14. One step growth of bacteriophage
15. Culture from body fluids (stool, urine, blood)
15. Identification of important fungi associated with post harvest rot of fruits and vegetables.
16. Isolation of microorganism from air, water and soil samples
17. Enumeration of microorganisms- total v/s viable count
18. Gram staining
19. Acid fast staining
20. Negative staining
21. Demonstration of enzyme action using a yeast fermentation system
22. Demonstration of the effect of temperature on yeast fermentation

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KANNUR UNIVERSITY

Scheme

and

Course Structure

**OPEN COURSES
(MICROBIOLOGY)**

UNDER

CHOICE BAED CREDIT SEMESTER SYSTEM

W.E.F 2009 ADMISSION

**The Project work shall be Laboratory/field based on research/survey in groups of 2/3 students and Project report shall be one for one group.*

Scheme Open Courses					
No	Semester	Course Code	Title of the course	Hours/week	Credit
1	V	5D01 MCB	Molecular Biology	2	2
2	V	5D02 MCB	Genetic Engineering	2	2
3	VI	6D01 MCB	Microbial Biotechnology	2	2
4	VI	6D02 MCB	Project Work	2	2

5D01 MCB MOLECULAR BIOLOGY

Hours/Week- 2

Credits- 2

Module I: Historical background of molecular biology - Mendelian view of world, Mendelian laws
Chromosomal theory of heredity mitosis and meiosis. Genes- One gene- one enzyme hypothesis.

Organization of bacterial and eukaryotic chromosome. DNA supercoiling Chromatin and Nucleoid structure. Histones and their function.

Module II: DNA as the Genetic material- Experimental evidences structure of DNA. The Watson Crick model and its importance. Chemical and physical properties of DNA. DNA Replication- Semi conservations mode of replication Origin, Forks and units of replication. Enzymes involved in DNA replication and its mechanism. Role of accessory proteins in replications. Initiation, Elongation and termination. Brief account of DNA repair - Mismatch repair, Base excision repair, Direct repair and SOS repair. Molecular mechanism of DNA recombination. Site-specific recombination, homologous recombination and transposition.

Module III: Chemistry of RNA-brief account - Ribosomal RNA Messenger RNA and Transfer RNA - DNA depended synthesis of RNA, RNA polymerases. Initiation, elongation and termination of RNA synthesis. Importance of promoters, sigma factor and rho factor in RNA synthesis. RNA processing in Prokaryotes and Eukaryotes. RNA Enzymes RNA depended synthesis of RNA and DNA brief account Reverse transcriptase and RNA replicase- brief account. Ribosomal structure- Prokaryotic and eukaryotic comparative account.

Module IV: Genetic code: codon assignment, Universality, Triplet binding and reading frame anticodons, Degeneracy, and wobble in the code.

Module V: Protein synthesis (Translation) Activation of amino acids, initiation, elongation termination and Release. Folding and post translational processing. Special signals of termination. Role of polysomes in translation.

Module VI: Regulation of Gene expressions: Operons and genetic regulation in Prokaryotes- Positive and negative regulation. Attenuation regulation- Lac operon and tryptophane operon as examples. Gene regulation by recombination. Eukaryotic gene regulation - Transcriptionally active and inactive form of Chromatin. Modification and Accessibility of DNA, Role of promoters in eukaryotic, genetic regulation. Basal transcription factors, DNA binding transactivators and coactivators. Intracellular and inter cellular signals and their role in Eukaryotic gene expression-brief account.

References:

- 1) Principles of Biochemistry - Lehninger
- 2) Molecular biology of the Gene - Watson et al
- 3) Genes IX - Benjamin Lewin
- 4) Microbial Genetics - Fretwell.

5D02 MCB Genetic Engineering

Hours/Week- 2

Credits- 2

Module I: History of Biotechnology before and after recombinant DNA technology. Present day scope of biotechnology, importance of biotechnology in production of human therapeutics, food agriculture and environmental protection- a brief outline,

Module II: Molecular cloning -Restriction enzymes, cloning vectors- plasmids, lambda phages, and cosmids. Introduction of recombinant DNA into host cell, detection of clone containing the desired gene. Expression of the clone gene in the host microorganism- production of insulin and interferon, production of synthetic vaccines-subunit vaccines and live recombinant vaccines.

Module III: Detailed study of production of transgenic plants and animals with specific examples, their importance.

Reference

Microbial biotechnology fundamental of applied microbiology - Alexander and Glazer et al
Industrial microbiology - L.E Casidea
Brocks biology of microorganisms - Madidan et al

6D01 MCB MICROBIAL BIOTECHNOLOGY

Hours/Week- 2

Credits- 2

Module I: Fermentation technology- isolation, screening and strain improvement of industrially important microorganisms. Introduction to fermentation processes- media for industrial fermentation, sterilization, inoculum preparation. Design and parts of fermenter-agitation, aeration. PH, temperature, dissolved oxygen- control and monitoring, difference in fermentation process for biomass, chemicals and conversion products-brief comparative account.

Module II: Brief account of industrial production of beer and bread, industrial alcohol, acetone, butanol, vinegar and citric acid by microorganisms.

Module III: Importance of amino acid fermentation- General aspects of mutant strains used for amino acid fermentation. Amino acid production by enzymes.

Module IV: Production of microbial enzymes and its importance- protease, invertase, amylase - brief account of enzyme technology. Immobilization of cells and enzymes- their important applications- biosensors.

Module V: Industrial production of pharmaceutical products- classes of antibiotics, development of beta lactams and semi synthetic penicillins. Industrial production of penicillin G. Production of vitamin B-12 and B-2.

Module VI: Bio insecticides-Bt, Baculoviruses- their importance.

Module VII: Techniques of down stream processes-separation of cells- filtration, centrifugation.

Purification methods-Chromatography and distillation. A brief account of economics of fermentation techno

Reference:

Microbial biotechnology fundamental of applied microbiology - Alexander and Glazer et al

Industrial microbiology - L.E Casidea

Industrial microbiology - Prescott and Dunn's

Brooks biology of microorganisms - Madidan et al

Sd/-

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