**B. Sc. Microbiology with Nanotechnology (Colleges) 2009-10**

**Annexure No. 33 B**

**Page 1 of 25**

**Bharatiar University, Coimbatore,**

**B. Sc. Microbiology with Nanotechnology Degree Course**

**Compulsory Diploma in Diagnostic Microbiology**

**Scheme of Examination - CBCS Pattern (Affiliated Colleges)**

For the students admitted during the academic year 2009 – 2010 batch onwards

<table>
<thead>
<tr>
<th>Part</th>
<th>Study Components</th>
<th>Course title</th>
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<td>Core Paper VII – Principles of Immunology</td>
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<td>Core Paper VIII – Food Microbiology</td>
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* - Students has to submit a record of work done during their training period which will be evaluated through viva voce along with the core practical III examination.

Students should undergo an institutional training for a continuous period of 15 days before semester VI

@ No University Examinations. Only Continuous Internal Assessment (CIA)

# No Continuous Internal Assessment (CIA). Only University Examinations.

**List of Elective papers (Colleges can choose any one of the paper as electives)**

<table>
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<tr>
<th>Elective – I</th>
<th>A Recombinant Dna Technology</th>
<th>B Virology</th>
<th>C Bioinstrumentation – Principles and Applications</th>
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<tr>
<td>Elective – II</td>
<td>A Fermentation Technology</td>
<td>B Dairy Microbiology</td>
<td>C Plant Biotechnology</td>
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<td>Elective - III</td>
<td>A Medical Microbiology</td>
<td>B Medical Biochemistry</td>
<td>C Entrepreneurial Microbiology</td>
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SEMESTER - I
CORE PAPER I : FUNDAMENTALS OF MICROBIOLOGY

UNIT – I

UNIT – II
Microscopy and Staining -Microscopy – Principles and application – Bright field, Dark field, Phase contrast, Fluorescence, SEM & TEMS- Specimen preparation of electron microscopy – freeze etching- Staining- Stains and Staining reactions – Types of staining – Simple, Differential (Gram’s, Spore, AFB_),Capsule staining, Nuclear and Flagella staining-Albert.

UNIT – III

UNIT – IV
Culture techniques -Media preparation -Solid and Liquid- Types of Media – Crude, Semi Synthetic, Synthetic, Enriched, Enrichment, Selective, Differential and Special Purpose Media (one eg for each type). Anaerobic culture technique— Wright’s tube, Roll tube, McIntost fildes jar method -Pure culture technique – Tube dilution, Pour, Spread, Streak and Micromanipulator.

UNIT – V

References
SEMESTER -II
CORE PAPER II : MICROBIAL DIVERSITY

UNIT – I

UNIT – II
Taxanomy of Eubacteria and Actinomycetes – Detailed classification upto genus level with general characters of each group – Bergey’s Manual and its importance.

UNIT – III
Taxanomy of Photosynthetic Eubacteria and Archaeabacteria- General characteristics.

UNIT – IV
Taxanomy of Fungi (Alexopolous) -General Characteristics-Life Cycles of Mucor, Neurospora, Agaricus, Dictyostelium.

UNIT – V

References

SEMESTER -II
CORE PAPER III :CELL BIOLOGY

UNIT – I

UNIT – II
UNIT III
Cell division in Bacteria – Binary fission - Cell division of Eukaryotes – Mitosis and Meiosis.

UNIT IV

UNIT V
Archaebacterial cell wall and cell membranes of Methanogens - Halophiles - Thermoacidiphiles.

References

SEMESTER II
CORE PRACTICAL 1

1. Laboratory precautions
2. Preparation of cleaning solutions
3. Antiseptics and disinfectants
4. Principles of aseptic techniques
5. Culture media preparation – Liquid and Solid medium
6. Selective and differential media
7. Methods of sterilization and testing of sterility
8. Enumeration of Bacteria, Fungi and Actinomycetes from soil
9. Pure culture techniques – pour plate, spread plate and looping method
10. Phenol co-efficient test
11. Cultural characteristics of microorganisms-colony morphology on nutrient agar slants, nutrients broth
12. Maintenance and preservation of cultures
13. Staining of bacteria-Simple, Negative, Gram, Spore and AFB, Fungal wet mount –LCB-Slide culture method
14. Isolation of halophiles and thermophiles
15. Cultivation of anaerobic micro organisms – Wrights tube – McIntosh fildes jar
16. Micrometry
References


SEMESTER –III
CORE PAPER IV : MICROBIAL PHYSIOLOGY

UNIT – I
Nutrition: Nutritional requirements of microorganisms – Autotrophs, Heterotrophs, Photoautrophs, Chemoautotrophs, Copiotrophs, Oligotrophs, Endospore formation in Bacteria.

UNIT – II

UNIT -III

UNIT- IV
Anaerobic respiration – sulphur , nitrogenous compounds and Co2 as final electron acceptor- Fermentation – alcoholic, propionic and mixed acid fermentation.

UNIT- V
Photosynthesis – Oxyegenic and Anoxygenic , Carbon dioxide fixation, Biosynthesis of bacterial cellwall, biosynthesis of aminoacids ( glutamic acid family )- Bioluminescence.
References

SEMESTER –IV
CORE PAPER V: BASICS OF MATERIAL SCIENCE

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

REFERENCE:
SEMESTER IV
CORE PRACTICAL II

1. pH measurements
2. Spectrophotometry
3. Protein estimation (Lowry et al/Bradford)
4. Paper chromatography
5. Thin layer chromatography
6. Electrophoresis - Proteins
8. Extraction of pigments
10. Preparation of Buffers – Acidic and Alkaline range
11. Preparation of Molar solutions
12. Preparation of 0.1 and 1 Normal solutions

SEMESTER V
CORE PAPER VI - MICROBIAL GENETICS

UNIT-I
DNA-the genetic material, RNA-the genetic material, characters of a genetic material, chemistry & molecular structure of DNA, special structure of DNA, structure and types of RNA.

UNIT-II
Bacterial chromosome, organization of genes in prokaryotes, DNA-replication in prokaryotes – Meselson and Stahl experiment- mechanism & enzymology of replication – theta replication & rolling circle replication.

UNIT-III

UNIT-IV
Mutation-spontaneous and induced-mutagen & mutagenesis – DNA repair mechanism.

UNIT-V
Genetic exchange – transduction(specialized & generalized), transformation, conjugation & Hfr mapping, genetic recombination.
References
2. Freifelder, S, 1987 Microbial Genetics, Jones & Bartlett, Boston.

SEMESTER - V
CORE PAPER VII - PRINCIPLES OF IMMUNOLOGY

UNIT- I
History and Scope of Immunology-The basis of defence mechanisms-Cell and Organs involved in immune system-Phagocytosis.

UNIT- II
Types of immunity-antigen-antibody-types-complement pathways-classical and alternate-Immunoglobins-structure and functions.

UNIT- III
Allergy and hypersensitivity-classification types and mechanisms-autoimmunity-mechanisms and autoimmune response diseases.

UNIT -IV
Quantitative study of antigen-antibody reactions –agglutination, precipitation ELISA-radiimmune assay(RIA)-monoclonal antibodies and its applications(Hybridoma technology)

UNIT – V
Immunohematology-blood transfusion-ABO grouping-Rh factor-Tissue transplantation-HLA typing-mechanism of acceptance and rejection.

References
SEMMESTER –V

CORE PAPER VIII - FOOD MICROBIOLOGY

UNIT – I
Food and microorganisms – Important microorganisms in food (Bacteria,mold and yeasts) ; factors affecting the growth of microorganisms in food – pH, moisture , oxidation – reduction potential , nutrient content and inhibitory substances and biological structure.

UNIT – II

UNIT -III
Spoilage of food - cereals , vegetables , fruits , egg and milk – canned foods .

UNIT-IV

UNIT- V
Food borne diseases – food poisoning and food borne infections – bacterial and mycotoxins- Investigation of food poisoning outbreaks- food standards, quality control.

References

SEMMESTER –V

CORE PAPER IX - INTRODUCTION TO NANOMATERIALS

UNIT I
Introduction and Classification: What is nanotechnology – Classification of Nanostructures - 1D, 2D and 3 D nanomaterials – Nanoscale Architecture.

UNIT II
UNIT III

UNIT IV

UNIT V

REFERENCE:

SEMESTER -VI
CORE PAPER X - NANOBIOTECHNOLOGY

UNIT I
Biological Inspired Concepts: Biological Networks – Biological Neurons – The Function of Neuronal Cell – Biological neuronal cells on silicon – Modelling of Neuronal cells by VLSI circuits.

UNIT II

UNIT III
Nanobiometrics: Introduction – lipids as nano-bricks and mortar- Self assembled nanolayers - the bits that do things - proteins – DNA Computer

UNIT IV

UNIT V
Nanoanalytics: Quantum dot Biolabelling – Nanoparticle Molecular labels – Analysis of Biomolecular Structure by AFM.
REFERENCE:

SEMESTER - VI
CORE PAPER XI
ENVIRONMENTAL AND AGRICULTURAL MICROBIOLOGY

UNIT-I
Distribution of microorganisms in nature – Microbial communities in soil- factors influencing the microbial density in soil- zymogenous and autochthonous flora in Soil-Microbial associations – symbiotic proto cooperation, ammensalism, Commensalism, syntropism, parasitism and predation with suitable examples.

UNIT-II

UNIT-III

UNIT-IV
Water microbiology, algae, phytoplankton- eutrophication- water treatment - Primary, secondary and tertiary. Drinking water- Portability- MPN technique.

UNIT-V
Aero microbiology- aerosol, droplet nuclei, air pollution- sources (Microbiological) – air quality analysis- air sampling devices.

References

SEMESTER - VI

CORE PAPER XII – BIOMEDICAL APPLICATIONS OF NANOMATERIALS

UNIT I

UNIT II

UNIT III
Nanoparticle : Implications for Drug Delivery : Introduction – Background – Studies on nanoparticle Flow – Convection and Diffusion – Bifurcations – Nanoparticles with Surface Ligands - Does Shape Matter ?

UNIT IV

UNIT V

REFERENCE:
SEMESTER VI
CORE PRACTICAL III

1. Isolation of Nucleic acids
2. Isolation of drug resistant mutants using UV and Chemical agents
3. Induction of Lac Operon – ONPG method
4. Isolation of *E. coli* plasmid DNA by agarose gel electrophoresis
5. Isolation and identification of major bacterial pathogens – *E. coli, Klebsiella pneumoniae, Proteus, Salmonella, Shigella, Pseudomonas, Staphylococcus aureus and Streptococcus pyogenes.*
6. Identification of clinically important fungi – *Candida albicans, Cryptococcus neoformans* and *Aspergillus*
7. Methylene blue reduction test
8. Microbial analysis of spoiled food – Bread and Vegetables
9. Identification of fungal food spoilers – *Aspergillus, Mucor, Penicillium, Rhizopus*
10. Direct microscopic examination of curd – observation of lactobacilli
11. Enzyme production and assay – protease and amylase
12. Alcohol production / wine
13. Immobilization- Demonstration
15. Observation of parasites – *Entamoeba, Plasmodium, Ascaris, Taenia.*
16. Isolation and titration of coliphages
17. Cultivation of animal viruses in embryonated eggs.

DIPLOMA IN DIAGNOSTIC MICROBIOLOGY
SEMESTER III - DIPLOMA PAPER I

ORGANIZATION OF CLINICAL MICROBIOLOGY LABORATORY

UNIT – I

UNIT – II
Laboratory safety. General safety considerations – biohazards and practices specific to microbiology – classification of biological agents on the basis of hazards.

UNIT – III
Special precautions for specific areas of clinical Microbiology – Bacteriology, Mycobacteriology, Mycology, Parasitology, Virology and Serology.
UNIT – IV  

UNIT – V  
Management of clinical Microbiology laboratory – general approaches– rapid detection – speeding up of identification results and susceptibility results – computerization.

References

1. Diagnostic Microbiology, Bailey & Scott, s, 1990 8th edn. The Mosby Company.
2. Medical laboratory manual for tropical countries, Microbiology by Monica chees brough (ELBS) Tropical health technology butter worth’s, 1985.

DIPLOMA PAPER II  
SEMESTER IV - DIAGNOSTIC MICROBIOLOGY – I  
(BACTERIOLOGY AND SEROLOGY)

UNIT – I  

UNIT – II  
Cultivation and isolation of viable pathogens – Media used – differential, selective, enrichment and enriched media.

UNIT – III  
Cultivation and isolation of viable pathogens – Media used – differential, selective, enrichment and enriched media.

UNIT – IV  
Biochemical tests – identification of organisms - Susceptibility testing, reporting of results and interpretation.

UNIT – IV  
Serology – Antigen - antibody reactions – Agglutinations (blood grouping, WIDAL), Precipitation (VDRL), Immunodiffusion – mono and double immunodiffusion, Immunoelectorophoresis (rocket, counter current).
UNIT – V
Advanced techniques – automated methods – ELISA, RIA. Applications of Nucleic acid hybridization, PCR and blotting in diagnosis.

References


DIPLOMA PAPER III
SEMESTER V - DIAGNOSTIC MICROBIOLOGY –II (VIROLOGY, MYCOLOGY AND PARASITOLOGY)

UNIT –I
Laboratory methods in basic Mycology – Collection and transport of clinical specimens – Direct Microscopic examination, culture media and incubation, Serological tests for fungi – Antifungal susceptibility testing

UNIT –II
Laboratory methods for parasitic infections – Diagnostic techniques for faecal, gastrointestinal and urino-genital specimen.

UNIT –III

UNIT –IV
Laboratory methods in basic virology- detection of viral antigen (fluorescent antibody and solid phase immunoassays). Viral Serology- Special consideration- Hepatitis and AIDS.

UNIT –V
Viral culture- Media and cells used – Specimen processing – isolation and identification of viruses.

References

SEMESTER VI
DIPLOMA PAPER IV

DIPLOMA PRACTICAL –I

2. Processing of specimen
   2.1- Gram’s Staining
   2.2- Motility
   2.3- Culturing techniques- McConkey agar, Blood agar, Chocolate agar, Mannitol salt agar and XLD agar
4. Susceptibility testing- Kirby Bauer method.

DIPLOMA PRACTICAL –II

1. Slide agglutination - Blood grouping
2. Tube agglutination- WIDAL
3. Precipitation – RPR
4. Immunodiffusion- Radial, Ouchterlony’s
5. Immunoelectrophoresis- Rocket and Counter current
6. ELISA
7. SDS-PAGE
8. Western blot
9. Observation of fungi- LCB or KOH mount
10. Observation of parasites- Entamoeba, Plasmodium, Ascaris, Taenia
ELECTIVE I – A

RECOMBINANT DNA TECHNOLOGY

UNIT –I
Nucleic acid purification – DNA, RNA; Nucleic acid modifying enzymes - Endonucleases, ligases, methylases, phosphatase, kinase – mode of action.

UNIT –II
Prokaryotic Vectors: Plasmid based - Natural (PSC101, PSF2124, PMB1), Artificial (pBR322, pUC); Phage based – phage and its derivatives, M13; Hybrid - Phagemid, Phasmid, Cosmid, BAC, YAC, Eukaryotic vectors: Ti plasmid, retrovirus.

UNIT –III
Gene Transfer Technique: Physical – Biolistic, DNA microinjection: Chemical- Calcium chloride, DEAE Method; Biological – Transfection, transformation; Selection – direct and indirect.
Techniques in rDNA: PCR, Blotting, RFLP, RAPD, Microarray, DNA finger printing, cDNA library, genomic library – methodology

UNIT IV

UNIT -V
Pharmaceutical products : Interferons, Human growth hormone; Vaccines – sub unit vaccines; monoclonal antibody. Human genome project; gene therapy; Bioethics in recombinant DNA technology.

References

ELECTIVE II – B : VIROLOGY

UNIT -I
UNIT II

UNIT-III

UNIT -IV
Viruses of Eukaryotes- Reproduction of animal and plant viruses- Viruses of Algae, fungi and viruses- viruses and cancer.

UNIT- V

References

ELECTIVE II – C : BIOINSTRUMENTATION – PRINCIPLES AND APPLICATIONS

UNIT – I
Autoclave , Hot air oven , Incubator , Water Bath , Laminar air flow, BOD incubator, Centrifuges – Bench top , High sped , Ultra centrifuge.

UNIT – II
pH meter , Conductivity meter, Lyophilizer , McIntosh anaerobic jar , Biosensor, Metabolic shaker.

UNIT -III

UNIT –IV

UNIT-V
Biochemical calculations-preparations of Molar solutions - Buffers- Phosphate, Acetate, TE, TAE- calculation of Normality ,PPM- Ammonium sulphate precipitation.
References
2. Dean, Willard and Merrit, Instrumental Methods of analysis Asian Ed.

ELECTIVE II – A : FERMENTATION TECHNOLOGY

UNIT -I
Industrially important strains- Screening methods- Strain development for Improved yield- Mutation, Recombination and protoplasmic fusion.

UNIT -II
Fermentation- submerged and solid state- component parts of a CSTR- types of Fermentors (Tower, cylindroconical & airlift) – batch fermentation – continuous Fermentation.

UNIT -III
Production of beverages – beer and wine- vitamin B12 and Riboflavin –

UNIT- IV
Single cell protein- Bakers yeast, spirulina- Details of mushroom development-
Oyster (Pleurotus) and Button (Agaricus) mushroom.

UNIT -V
Downstream process- Intercellular and extracellular- Centrifugation, filtration,
Floatation- solvent extraction, precipitation- Breakage of cells- physical and Chemical methods.

References
ELECTIVE II – B : DAIRY MICROBIOLOGY

Unit I

Unit II
Milk and milk products – Definitions, composition, food and nutritive value of milk, properties of milk and its constituents. Dairy Products Production : Overview and Fluid Milk Products, Concentrated and Dried Milk Products, condensed milk, evaporated milk, whole and skimmed milk powder, cultured Dairy Products: Cheese, yogurt, fermented beverages, Whipped Cream, Ice Cream, Butter, Whey Products, fermented milks,

Unit-III
Microbiology of fermented milk products - Acid fermented milks (acidophilus milk, yoghurt). Slightly acid fermented milks (Cultured butter milk), Acid-alcoholic fermented milk (Kefir). Fermented milk production with extended self life (labneh). Milk borne diseases, antimicrobial systems in milk, sources for contamination of milk - bacterial with examples of infective and toxic types –, Clostridium, Salmonella, Shigella, Staphylococcus, Campylobacter, Listeria. Mycotoxins in food with reference to Aspergillus species.

Unit – IV

Unit V
Quality assurance: Microbiological quality standards of food. Government regulatory practices and policies. FDA, EPA, HACCP, ISI. HACCP – Food safety, safety of dairy products, control of hazards

References
3. Applied dairy microbiology edited by Elmer Marth and James Steele.
   Science, UK.

ELECTIVE II – C : PLANT BIOTECHNOLOGY

UNIT – I

   Plant Tissue culture – History. Plant tissue culture media, types, constituents and
   preparation of media, selection of suitable medium.

UNIT – II

   Protoplast culture and somatic hybridization, production of Haploid plants,
   Somaclonal variations, Clonal propagation (micro propagation) germplasm conservation
   and cryopreservation.

UNIT – III

   Genetic Engineering of plants – Gene transfer methods – vector mediated gene
   transfer, virus – mediated gene transfer, Direct or Vectorless DNA transfer.

UNIT – IV

   Application of Transgenic plants – Resistance to biotic stresses – Insect resistance
   plant virus, bacteria and fungi resistance, abotic stress – herbicide resistance plants.

UNIT – V

   Molecular Marker Aided plant Breeding – Molecular markers, Molecular marker
   assisted selection, Arid & semi-arid plant Biotech, Green house & Green home
   technology.

References:
Dr. U. Sathyanarayana – Biotechnology. Books and Allied Publications

Winnacker, E.L. 1989: From genes to clones. Introduction to Gene Technology. VCH
Weinhein.

Scientific Publication. London.

applications of recombinant DNA. ASM Press, Washington.
ELECTIVE III – A : MEDICAL MICROBIOLOGY

UNIT- I
Infections- sources of infections- types of infections - methods of infections- definitions- epidemic, pandemic, endemic diseases - Epidemiology of infectious diseases, infectious diseases cycle- investigation of epidemics - control of epidemics.

UNIT- II
Morphology, pathogenicity and laboratory diagnosis - Gram positive organisms - Staphylococcus aureus, Streptococcus pyogenes, Bacillus anthracis, Clostridum tetani, Gram negative organisms – Escherichia coli, Klebisella, Shigella, Pseudomonas, Vibrio cholerae.

UNIT- III

UNIT -IV

UNIT -V
Antibiotics and chemotherapeutic agents - Mechanism of actions – Drug resistance – Antimicrobial susceptibility testing - Disc diffusion - Kirby Bauer.

References

ELECTIVE III – B : MEDICAL BIOCHEMISTRY

Unit I
Disorders of carbohydrate metabolism – Diabetes mellitus, Glucose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia

Unit II
Disorders of lipids- Plasma lipo proteins, cholesterol, triglycerides and phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher’s disease, Tay-Sach’s, ketone bodies, ß-lipoproteinemia

Unit III
Disorders of liver and kidney- Jaundice, fatty liver, normal and abnormal functions of liver and kidney, inulin and urea clearance

Unit IV
Abnormalities in nitrogen metabolism- Uremia, hyperurecemia, porphyria and factors affecting nitrogen balance

Unit V

References

ELECTIVE III – C : ENTREPRENEURIAL MICROBIOLOGY

UNIT I:
Entrepreneur development, activity, Institutes involved, Government contributions to entrepreneurs, risk assessment. Industrial Microbiology, Definition, scope and historical development.

UNIT II:
Microbial cells as fermentation products- Bakers yeast, food and feed yeasts, Bacterial Insecticides, Legume Inoculants, Mushrooms, Algae. Enzymes as fermentation products- Bacterial and Fungal Amylases, Proteolytic Enzymes, Pectinases, Invertases, and other enzymes.

UNIT III:
Mushroom cultivation and Composting- Cultivation of Agaricus campestris, Agaricus bisporus, and Volvariella volvacea; Preparation of compost, filling tray beds, spawning, maintaining optimal temperature, casing, watering, harvesting, storage. Biofertilizers- Historical background, Chemical fertilizers versus biofertilizers, organic farming. Rhizobium sp, Azospirillum sp, Azotobacter sp, as Biofertilizers.

UNIT IV:

UNIT V:
Brewing- Media components, preparation of medium, Microorganisms involved, maturation, carbonation, packaging, keeping quality, contamination, by products. Production of Industrial alcohol.

References:
Industrial Microbiology- L.E.Casida, jr, New age International publication.
Entrepreneurial Development in India- By Arora
Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom production technology- K.R.Aneja, New age International publication.