DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.ACAD/NP/B.Sc.-Ist Yr./SEM.-I & II/157/2013

It is hereby notified for information of all concerned that, on the recommendations of the Boards of Studies, Ad-hoc Boards, and Faculty of Science, the Academic Council at its meeting held on 25-03-2013 has accepted the following revised syllabi for B.Sc. First Year progressively under the Faculty of Science :-

Sr. No.	Revised Syllabus	
[1]	B.Sc. [Physics]	Semester- I & II,
[2]	B.Sc. [Dairy Science & Technology]	Semester- I & II,
[3]	B.Sc. [Industrial Chemistry]	Semester- I & II,
[4]	B.Sc. [Geology]	Semester- I & II,
[5]	B.Sc. [Chemistry]	Semester- I & II,
[6]	B.Sc. [Botany]	Semester- I & II,
[7]	B.Sc. [Electronics] Science	Semester- I & II,
[8]	B.Sc. [Fisheries]	Semester- I & II,
[9]	B.Sc. [Microbiology]	Semester- I & II,
[10]	B.A. [Statistics]	Semester- I & II,
[11]	B.Sc. [Statistics]	Semester- I & II,
[12]	B.Sc. [Zoology]	Semester- I & II,
[13]	B.Sc. [Textile and Interior Decoration]	Semester- I & II,
[14]	B.Sc. [Home Science]	Semester- I & II,
[15]	B.A. / B.Sc. [Mathematics]	Semester- I & II.

This is effective from the Academic Year 2013-2014 and onwards.

These **syllabi are available on the University Website www.bamu.net**

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.ACAD/NP/B.SC.-IST YEAR/
Sem-I & II/2013/5132-541
A.C.S.A.I.No.327[9].

Date:- 08-05-2013.

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Director,
Board of College and
University Development.

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Copy forwarded with compliments to :-

1] **The Principals, affiliated concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University.

2] The Director, University Network & Information Centre, UNIC, with **a request to upload the above all syllabi on University Website [www.bamu.net].**

Copy to :-

1] The Controller of Examinations,

2] The Superintendent, [B.Sc. Unit],

3] The Superintendent, [B.A. Unit],

4] The Superintendent, [Eligibility Unit],

5] The Programmer [Computer Unit-1] Examinations,

6] The Programmer [Computer Unit-2] Examinations,

7] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter,
Dr. Babasaheb Ambedkar Marathwada University,

8] The Public Relation Officer,

9] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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S/-080513/-*

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Revised Syllabus of

B.Sc. Ist Year

MICROBIOLOGY

SEMESTER-I & II

[Effective from 2013-14 & onwards]

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGBAD

Course Structure

YEAR	SEMESTER	PAPER NUMBER	PAPER TITLE	Hours	MARKS
First	I	Paper – I	Fundamentals of Microbiology	45	50
		Paper - II	Microbiological Techniques & General Microbiology	45	50
		Paper - III	Practical [based on Paper- I & II]	45	50
	II	Paper – IV	Cytology and general Microbiology	45	50
		Paper – V	Basic Biochemistry	45	50
		Paper – VI	[based on Paper No.IV & V] Practical	45	50
				270	**300**

B.Sc. First Year Semester – I
Paper I .Fundamentals of Microbiology

Unit - 1

1 Scope & relevance of Microbiology

i) Definition & concepts

ii) Types of microorganism

iii) Distribution of microorganisms in nature

2. Development of Microbiology as a Scientific Discipline

i) Early observation of microorganisms

ii) Spontaneous generation conflict : Contribution of scientists

iii) Recognition of the microbial role in diseases. Koch's postulates

iv) Recognition of microbial role in fermentations.

v) Discovery of microbial effects on organic and inorganic matter.

vi) Pure culture concept.

vii) Aseptic surgery

Unit – 2 General characteristics of microorganisms.

2.1 General principles (Bacteria)

i) Taxonomic rank

ii) Classification system

iii) Numerical taxonomy

iv) Major characteristics used in taxonomy. Morphological, Physiological, Immunological, Metabolic, Etiological. Compositions of proteins, composition of nucleic acids, hybridization, nucleic acid sequencing, identification of organisms based on 16srRNA sequencing, 16S rDNA sequencing

v) Bergey's manual of systematic Bacteriology,General characteristics enlisting all parts with major characters & examples. (Vol I to IV)

Unit – 3 General characteristics of Microorganisms

3.1 Structure, Reproduction (Lytic & Lysogenic cycle)classification of Viruses.(LHT system)

3.1 General characters of Fungi (including yeasts)

3.2 General characters of Actinomycetes

3.3 General characters of Algae

3.4 General characteristics of Mycoplasma and Rickettssia.

3.5 General characteristics of Archaebacteria

Unit – 4 **4.1 Microscopy**

i) Definitions : Magnification, resolving power, depth of focus, focal length, numerical aperture.

ii) Objectives Low , high & oil immersion.

iii) Oculars : function, Huygenian, Ramsden, Hyperplane & compensating.

iv) Condensers ; Abbe, variable focus cordiod, parabolic & their functions.

v) Iris diaphragm.

4.2 Principles, construction using ray diagram, application and comparative study of :

i) Compound Microscope

ii) Electron Microscope – SEM, TEM

4.3 Principles, ray diagram & applications.

i) Phase contrast microscope.

ii) Dark field microscope.

iii) Fluorescent microscope.

iv) Advanced applications of microscopes.

Semester – I Paper II

Microbiological Techniques & General Microbiology

Unit – 1 Stains and dyes.

i) Definition : stain, dye, chromogen, chromophore, auxochrome, acidic and basic stains, simple and differential staining. (Gram's and Acid fast staining) , natural stains, mordant, decolourizer, counter stains.

ii) Physicochemical basis of staining.

iii) Fixatives and fixation of smears.

iv) Staining of Fungi.

v) Principle, application and methodology of Negative, Monochrome and Grams Staining

Unit – 2 Cultivation of microorganisms.

i) Properties of a good culture medium.

ii) Definition, concept, use and types of different culture media . Synthetic, non synthetic, natural, selective, differential, enriched , enrichment, assay, minimal, maintenance, and transport media.

iv) Role of Buffers in culture media.

v) Media used for cultivation of bacteria , fungi, actinomycetes, yeasts, algae and photosynthetic bacteria. (at least two)

Cultivation of anaerobes

i) Principle and examples.

ii) Methods (at least 2)

Unit – 3 Microbiological Techniques

1. Pure culture techniques

i) Development of pure culture

ii) Aseptic techniques, streak, pour and spread plate methods, single cell isolation.

iii) Significance

2. Sterilization techniques

i) Pattern of Microbial death – concepts.

ii) Sterilization by physical methods

- High temperature, canning and pasteurization.
- Low temperature.
- Non ionizing and ionizing radiations.
- Bacteriological filters.

iii) Disinfection by chemical means;

Disinfectants and antiseptics:

Effectiveness, mode of action & application.

Phenolics, alcohols, halogens, heavy metals, quaternary ammonium compounds, aldehydes.

iv) Sterilization using gases

sulfur dioxide, ethylene oxide, Beta propiolactone.

Unit – 4 Structural Organization of microorganisms.

A] Fundamental categories of microorganisms.

i) Procaryotic & Eucaryotic cell concepts and differential account

B] Role of microorganisms:

1.1 In agriculture : As biofertilizers, bioinsecticides, in soil improvement (texture , water holding capacity) as geochemical agents, microbe plant interactions (phyllosphere, rhizosphere, mycorrhizal and nodule formation). Plant diseases : list of common plant diseases with their causative agents.

1.2 In human and animal health : list of common bacterial, rickettsial , fungal and viral diseases.(with causative agents) in human beings, role of normal flora of human body, antibiotics, vaccines and antisera.

1.3 In industries : list of microbial products (and producers) produced on industrial scale, role of contaminants.

1.4 In food processing : list of common fermented food & milk products with their representative organisms. Food spoilage, list of organisms causing changes in texture, colour, aroma, taste & nutritional value of the food products. List of food poisoning & food infection causing microorganisms.

B.Sc. First Year Semester I

Paper III .Practical
[based on Paper- I & II]

1) Microscopy :
   - i) Different parts of a compound microscope.
   - ii) Use and care of compound microscope .
   - iii) Visit to see an electron microscope .

2) Construction , operation and utility of laboratory equipments
   - i) Autoclave
   - ii) Hot air oven
   - iii) Incubator
   - iv) pH meter
   - v) High speed centrifuge
   - vi) Colorimeter/ spectrophotometer
   - vii) Anaerobic jar
   - viii) Bacterial Filters
   - ix) Laminar air flow.

3) Demonstration of presence of bacteria from – soil/ water/ air/ milk

4) Demonstration of yeast, fungi, actinomycetes, algae, protozoa

5) Microscopic examination of bacteria:
   - i) Monochrome staining
   - ii) Negative Staining
   - iii) Gram's Staining

6) Hanging drop technique to demonstrate bacterial motility

7) Micrometry

8) Qualitative tests for:
   - i) Carbohydrates – Benedict's test.
   - ii) Protein – Buiret test.
   - iii) Nucleic acid – Diphenylamine(DNA) and orcinol (RNA)tests

B.Sc. First Year

Semester II

Paper-IV Cytology and general Microbiology

Unit – 1 : 1. **Bacterial morphology and ultra structure.**

1.1 Cytology of a typical bacterial cell.

i) Morphology – size and arrangement of bacterial cells.

ii) Structure ,chemical compositions and functions of :

1. Capsule and slime layer
2. Cell wall : Gram positive and Gram negative bacteria
3. Unit membrane
4. Flagella : Arrangement, mechanism of flagellar movement, Chemotaxis, phototaxis, Magnetotaxis.
5. Pili
6. Ribosomes.
7. Nuclear material, Mesosome
8. Reserved food material: Poly beta hydroxy butyric acid granules, glycogen and polyphosphate granules.

1.2 Bacterial cell division

i) Binary fission

Unit – 2 Nutritional Requirements

i) Concept.

ii) Common nutritional requirements – Energy sources, C, N, P, O,S, micronutrients, growth factors, water etc.

iii) Classification on the basis of carbon and energy

Bacterial growth

i) Concept of Growth

ii) Definition

iii) Bacterial growth curve

iv) Phases of growth

v) Mathematics of growth

vi) Diauxy

vii) Factors influencing bacterial growth (temp, pH, oxygen and nutrients).

viii) Synchronous growth

ix) Continuous culture

x) Measurement of bacterial growth

Unit – 3 Microbial Physiology

1. **Endospore** – types, sporulating bacteria ,architecture of endospore, sporulation process , germination process.
2. **Uptake of nutrients**

i) Passive diffusion

ii) Facilitated diffusion

iii) Active transport mechanism.

iv) Group translocation

vi) Uptake of amino acids and metals

3. **Anaerobic respiration :**

NO_3 , SO_4 and CO_2 as electron acceptors.

4. **Bacterial photosynthesis :**

i) Photosynthetic bacteria,

ii) Photopigments and associated carriers,

iii) Photosynthetic apparatus and its mechanism

iv) Cyclic and non cyclic photophosphorylation ,

v) Calvin cycle, and reductive carboxylic acid cycle for CO_2 fixation.

vi) Differences between bacterial and plant photosynthesis.

Unit – 4 Advances in Microbiology

a) Genetic engineering.
b) Bioinformatics
c) Nano biotechnology
d) Bioaugmentation
e) Biostatistics
f) Enzymes and cell immobilization

Semester II

Paper-V Basic Biochemistry

Unit – 1 Carbohydrates

i) Definition and classification.

ii) Properties –optical and chemical.

iii) Structure of glucose: ring structure, Haworth & fisher's projection, pyranoses , furanoses, isomers, mutarotation.

iv) Triose, pentose, hexose, heptoses - examples & structures.

v) Derived monosaccharides: glycosides, furano acids, sugar phosphates, uronic acids, sugar alcohol.

vi) Disaccharides , glycoside linkage, lactose, maltose, sucrose.

vii) Oligosaccharides – Trisaccharides, structure of raffinose.

viii) Polysaccharides – Homo and heteropoly saccharides ,structures starch, cellulose, mucopolysacchrides.

ix) Biological significance

Unit – 2 Lipids

i) Classification simple compounds.

ii) Chemistry of fatty acids, unsaturated and saturated fatty acids, trigycerides, saponification alkyl ether phospho glycerides , sterols, cholesterol , protaglandins, glycol lipids.

iii) Function of lipids.

Unit – 3 Proteins

i) Classification based on properties of solubility & heat. coagulability. Fibrous, globular proteins and functions.

ii) Protein structures ; conformation & configuration ,primary structure determination, secondary structure π - helix & β - pleated sheet, tertiary & quaternary structure.

iii) Classification of amino acids : based on acid – base properties.

iv) Properties of amino acids – solubility, ampholyte, Zwitterions isoelectric pH .

v) Peptide bonds – Concepts of biological peptide bond formation, types.

vi) Enzymes – Concepts, definition, nature , active site, properties, physico-chemical factors contributing to catalytic efficiency of enzymes

Unit – 4 **Nucleic acids**

i) Structure of nitrogen bases & base pairing.

ii) Structure of nucleosides & nucleotides, ribose, deoxyribose sugars.

iii) DNA : properties, forms , structure, function as genetic material. Types of DNA

iv) RNA : Structure, function, types (r-RNA, m-RNA, t-RNA)

v) Comparative account of DNA & RNA.

PH & buffers. pH titration curve, P_K value.

B.Sc. First Year Semester II

Paper-VI Practical

[based on Paper No.IV & V]

1) Structural staining –

- ♦ Bacterial flagella by Patel, Kulkarni and Gaikwad method
- ♦Capsule staining – Maneval's method.
- ♦Cell-Wall staining- Chance's method.
- ♦Spore staining – Schaefer &Fulton's method.
- ♦Lipid (PHB) granule staining- Burdon's method.
- ♦Metachromatic granule staining- Albert and Neusser's method.
- ♦Preparation of culture media.
  - i) Nutrient brothh and agar
  - ii) MacConkeys broth and agar..
  - iii) Sugar media
  - iv) Potato dextrose agar
  - v) Blood agar
  - vi) Photosynthetic bacterial growth medium

2) Sterility checks for Autoclaving

3) Isolation of microorganisms from :

- i) Air
- ii) Water
- iii) Soil
- iv) Milk

4) Isolation of bacteria from mixed cultures (streak plate method)

5) Cultivation of Anaerobes

6) Effect of physical and chemical agents on growth of bacteria.

- i) pH
- ii) Temperature.
- iii) Heavy metal ions (oligodynamic action)
- iv) UV rays.
- v) Antibiotics.

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डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ, औरंगाबाद

परिपत्रक क्रमांक/एस.यु./विज्ञान/अभ्यासक्रम/७४/२०१४

या परिपत्रकाद्वारे सर्व संबंधीतांना सुचित करण्यात येते की, विज्ञान विद्याशाखेने शिफारस केल्यानुसार बी. एस्सी. / एम. एस्सी. प्रथम व द्वितीय वर्षाच्या सुधारित अभ्यासक्रमास आणि बी. एस्सी. प्रथम वर्षाच्या अभ्यासक्रमात किरकोळ बदल करण्यास विद्यापरिषदेच्या वतीने मा. कुलगुरु यांनी, त्यांना प्राप्त असलेल्या विशेष अधिकार महाराष्ट्र विद्यापीठ अधिनियम-१९९४ कलम १४(७) अन्वये मान्यता दिलेली आहे. त्या अनुषंगाने सुधारीत तयार केलेल्या अभ्यासक्रमाची प्रत या परिपत्रकासोबत आपल्या पुढील कार्यवाहीसाठी पाठविण्यात येत आहे.

[1]	B.Sc. Physics	Semester-III & IV,
[2]	B.Sc. Chemistry	Semester-III & IV,
[3]	B.Sc. Botany	Semester-III & IV,
[4]	B.Sc. Zoology with minor changes	Semester-I & II,
[5]	B.Sc. Zoology	Semester-III & IV,
[6]	B.Sc. Fisheries	Semester-III & IV,
[7]	B.Sc. Electronics (Opt.)	Semester-III & IV,
[8]	B.A./B.Sc. Mathematics	Semester-III & IV,
[9]	B.Sc. Computer Science	Semester-I & II,
[10]	B.Sc. Information Technology	Semester-I & II,
[11]	B.C.A.	Semester-I & II,
[12]	B.Sc. Computer Science(Opt.)	Semester-I & II,
[13]	B.Sc. Information Technology(Opt.)	Semester-I & II,
[14]	B.Sc. Computer Application(Opt.)	Semester-I & II,
[15]	B.Sc. Computer Maintenance(Opt.)	Semester-I & II,
[16]	B.Sc. Biotechnology (Progressively)	Semester-I to VI,
[17]	B.Sc. Biotechnology (Opt.) (Progressively)	Semester-I to IV,
[18]	B.Sc. Sericulture Technology	Semester-I & II,
[19]	B.Sc. Networking Multimedia	Semester-III & IV,
[20]	B.Sc. Bioinformatics	Semester-I & II,
[21]	B.Sc. Hardware & Networking	Semester-I & II,
[22]	B.Sc. Animation	Semester-I & II,
[23]	B.Sc. Dairy Science & Technology	Semester-III & IV,
[24]	B.Sc. Biochemistry	Semester-III & IV,
[25]	B.Sc. Analytical Chemistry	Semester-III & IV,
[26]	B.Sc. Textile & Int. Decoration with minor changes	Semester-I & II,
[27]	B.Sc. Textile & Int. Decoration	Semester-III & IV,
[28]	B.Sc. Home Science with minor changes	Semester-I & II,
[29]	B.Sc. Home Science	Semester-III & IV,
[30]	B.Sc. Agro.Chem. & Fertilizers	Semester-III & IV,

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[31]	B.Sc. Geology	Semester-III & IV,
[32]	B.A. Statistics with minor changes	Semester-I & II,
[33]	B.A. Statistics	Semester-III & IV,
[34]	B.Sc. Statistics with minor changes	Semester-I & II,
[35]	B.Sc. Statistics	Semester-III & IV,
[36]	B.Sc. Industrial Chemistry	Semester-III & IV,
[37]	B.Sc. Horticultural	Semester-I & II,
[38]	B.Sc. Dry land Agriculture	Semester-I & II,
[39]	B.Sc. Microbiology	Semester-III & IV,
[40]	M.Sc. Computer Science	Semester-I to IV,
[41]	M.Sc. Information Technology	Semester-I to IV.

हा सुधारीत व नवीन तयार केलेल्या अभ्यासक्रमाचा आराखडा शैक्षणिक वर्ष २०१४-१५ करिता मर्यादित असेल व विद्यापरिषदेच्या अंतिम मान्यतेनंतर हे परिपत्रक नियमित ठेवण्याबाबत या कार्यालयाद्वारे नवीन परिपत्रक पारीत करण्यात येईल. तसेच सुधारीत व नवीन तयार केलेल्या अभ्यासक्रमाची प्रत विद्यापीठाच्या संकेतस्थळावर उपलब्ध आहे.

करिता, या परिपत्रकाची सर्व संबंधितांनी नोंद घ्यावी.

विद्यापीठ प्रांगण,
औरंगाबाद-४३१ ००४.
संदर्भ क्र.एस.यु./सा.शा./सबवि /२०१३-१४/
६५९९-७०२
दिनांक :- २७-०५-२०१४.

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संचालक,
महाविद्यालये व विद्यापीठ
विकास मंडळ.

या परिपत्रकाची एक प्रत :-

१) मा. परिक्षा नियंत्रक, परिक्षा विभाग,
२) मा. प्राचार्य, सर्व संलग्नीत महाविद्यालये,
३) संचालक, युनिक यांना विनंती करण्यात येते की, सदरील अभ्यासक्रम विद्यापीठाच्या संकेतस्थंळावर उपलब्ध करुण देण्यात यावेत.
४) संचालक, ई-सुविधा केंद्र, विद्यापीठ परिसर,
५) जनसंपर्क अधिकारी, मुख्य प्रशासकीय इमारत,
६) कक्ष अधिकारी, पात्रता विभाग, मुख्य प्रशासकीय इमारत,
७) कक्ष अधिकारी, बी.ए. / बी.एस्सी./ बी.सी.एस./एम.एस्सी. विभाग, परीक्षा भवन,
८) अभिलेख विभाग, मुख्य प्रशासकीय इमारती मागे,

डॉ. बाबासाहेब आंबेडकर मराठवाडा विद्यापीठ, औरंगाबाद.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD.

Revised Syllabus ofB.Sc. Second Year

[Microbiology] D-9 optional

Semester- III & IV

(Effective from June 2014 onwards)

DR BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Course Structure

Year	Semester	Paper number	Paper Title	Periods	Marks
B. Sc. Second	III	Paper-VII	Environmental Microbiology	45	50
		Paper-VIII	Immunology	45	50
		Paper-IX	Practical	45	50
		Paper-X	Practical	45	50
	IV	Paper-XI	Applied Microbiology	45	50
		Paper-XII	Clinical Microbiology	45	50
		Paper-XIII	Practical	45	50
		Paper-XIV	Practical	45	50
			Total	360	400

B.Sc. Second Year [Microbiology]
Semester IIIPaper VII
Environmental Microbiology

Unit 1: Microbiology of air:

- Composition of air.
- Number and kinds of microorganisms in air (indoor, outdoor)
- Distribution and sources of air borne microorganisms.
- Air as a carrier of microorganisms.
- Droplet, droplet nuclei, Dispersal of Microorganisms in air.
- Techniques for microbiological analysis of air.
- Significance of air flora in human health, hospitals, industries.
- Air sanitation – dust control, UV radiation, bactericidal vapors, filtration, Laminar air flow system (HEPAfilters)

Unit 2. Microbiology of Water and Waste water:

- Types of waters, sources of microbes in water.
- Determining sanitary quality of water indicators of fecal pollution:Fecal and non-fecal coliforms (IMViC& elevated temperature tests).
- Bacteriological examination of water: Presumptive, confirmed, completed test, SPC, MPN and Membrane filter technique.
- Water purification methods: Disinfection of potable water supplies.
- Definition of sewage and chemical composition.
- Microbiology of sewage treatment: septic tank, evapotranspiration, Imhoff's tank
- Muncipal sewage treatment process: Primary, Secondary, (aerobic and anaerobic process), chemical treatment: chlorination.
- Disposal of treated sewage. (Sludge as fertilizer, irrigation and dilution)

Unit 3.Microbiology of Soil:

- Soil as an environment, as a culture medium.
- Brief account and definition of microbial interactions with examples.
- Symbiosis, mutualism, commensalism, competition, synergism, satellitism, predation, parasitism with example:
  I. Microbe-microbe interactions (any one example)
  II. Plant-microbe interactions (Phyllosphere; legu.plant-Rhizobium)
  III. Animal-microbe interactions(Rumen; Bioluminescence)
- Major biogeochemical cycles:Carbon nitrogen, phosphorus, sulphur (cyclic turnover with microbiology).
- General account of microbes used as biofertilizers, phosphate solubilizers. (Defination, Types, advantages, disadvantages)
- Rhizosphere: definition, rhizosphere and non rhizospheremicroflora and R: S ratio, significance for fertility.

Unit 4. Environmental Pollution

- Air pollution : sources, causes, health hazards, airborne diseases any 5 (list of causative agents)
- Water pollution : sources, causes, health hazards, waterborne diseases any 5 (list of causative agents).
- Waste water pollution : sources, causes, health hazards.
- Soil : sources, causes, health hazards,

B.Sc. Second Year Semester III
Paper VIII Immunology

Unit 1.Gnotobiology

- Normal flora of human body.
- Defensive mechanism of the host
- Nonspecific factors: physiological barriers, natural cellular & humoral factors.
- Aggressive factors and mechanisms.
- Infection:
- Definitions with one example: (primary infection, secondary infection, cross infection)
- Sources of infection.
- Determining factors in infection
- Modes of transmission of infectious diseases.
- Process of infection : entry and spread of infection in host body

Unit 2.Immune system and Immune responses:

- Immune system : organs and cells Involved, functions, types of cells functions of immune system.
- Production of antibodies: organs & cells involved, monoclonal Antibodies, Regulation of antibody production (genetic control).
- Factors influencing antibody production:
- Introduction to stem cells and stem cell therapy.

Unit 3. Immunity:

- Definition and classification:Innate / Acquired, Active/Passive, Cellular/Humoral, specific / non - specific humoral factors of immunity: complement, interferon.

Antigen:

- Definition, determinant's of antigenicity, a) size, b) chemical, c) nature, d) susceptibility to tissue enzymes, foreignness, specificity of antigens,
- Types of antigens: species specific antigen, Isoantigen, autoantigen, organ specific antigen, MHC antigen, Heterogenetic (Heterophile)antigen, antigens in relation to bacterial cell.

Antibody:

- Immunoglobulins: structure & classes,
- Types of antibodies:antitoxin, precipitin, agglutinin, bacteriolysin, bacteriocidin, bacteriotropin, complement fixing, neutralizing.

Unit 4.Antigen – Antibody reactions:

- General features of Antigen- Antibody reactions
- Mechanisms , methods & applications of:
  - Agglutination:
  - Precipitation
  - Complement fixation
  - Neutralization
  - Immunofluorescence
  - ELISA
- General methods of prophylaxis.
  - Toxoid & immune sera, Principle involved in preparation. use of adjuvants.
  - Vaccines : types, principles of methods of BCG, TAB, OPV, T.T., DPT, vaccines production, administration of vaccines, Immunization schedule.

- Hypersensitivity (Four types with one disease in brief)

B.Sc. Second Year Semester IV
Paper XI Applied Microbiology.

Unit 1. Dairy Microbiology:

- Definition of and composition of milk
- Sources of microorganisms in milk
- Desirable and undesirable changes carried out by microorganism in milk
- Types of microorganisms: Biochemical types, temperature characteristic and pathogens (bovine and human origin).
- Changes in the flora of raw milk stored at room temp.
- Microbiological examination of milk: SPC, DMC, Reductase and Phosphatase test.
- Sterilization of milk: Pasteurization

Unit 2.Food Microbiology:

- Food as a substrate for microorganisms.
- Major groups of bacteria, fungi, yeasts important in food microbiology.
- Sources of contamination of food, factors affecting kind and number of microorganisms in food.
- Principles of food preservation:
- Microbiostatic and microbicidal methods : Asepsis, removal of microorganisms, anaerobic conditions, high temp, low temp, drying, chemical preservatives, high osmotic pressure, radiation, smoking.
- Microbial spoilage of foods.
- Classification of foods by ease of spoilage, chemical changes caused by microorganisms in food.
- Types of spoilage of canned and non-canned foods with organisms involved. (Tabular form).

Unit 3.Foodborne diseases and intoxication

- Food borne diseases: Food infections, indicators of food pathogens associated with food.
- Food intoxication: Staphylococcal, Clostridial,Mycotoxins,Enteropathogenic*E. coli*, Salmonellosis and Shigellosis.

Unit 4.Fermented Food and Probiotics

- Cheese: Classification and production
- Butter
- Idli
- Criterion for probiotics: Yoghurt and Curd
- Mushroom as SCP

B.Sc. Second Year Semester IV
Paper XII Clinical Microbiology

Unit 1.Study of Human Diseases caused by bacteria

Classification, habitat, morphology, staining reactions, cultural characters, biochemical characters, antigenic structure, pathogenesis.Laboratory diagnosis, epidemiology, prophylaxis, chemotherapy w. r. t.

- *Staphylococcus aureus*
- Pneumococcus *(Str.pneumoniae)*
- *Mycobacterium tuberculosis*

Unit 2.Study of Human Diseases caused by Enteric bacteria and spirochete

Classification, habitat, morphology, staining reactions, cultural characters, biochemical characters, antigenic structure, pathogenesis.Laboratory diagnosis, epidemiology, prophylaxis, chemotherapy w. r. t.

- *Salmonella typhi*
- *Vibrio cholera*
- *Treponema pallidum*

Unit 3 Viruses

- HIV: Morphology, types, Life cycle, pathogensis, Laboratory diagnosis, epidemiology Prophylaxis, treatment.
- Hepatitis virus : Morphology, types, Life cycle, pathogensis, Laboratory diagnosis, epidemiology, Prophylaxis, treatment.
- Oncogenic viruses: Morphology, types, Life cycle, pathogenesis, Laboratory diagnosis, epidemiology, Prophylaxis, treatment.

Unit 4.

- Protozoa:*Plasmodium spp (morphology, life cycle, clinical signs and symptoms, lab. Diagnosis prophylaxis / prevention and chemotherapy.*
- Fungi: *Candida albicans (morphology, clinical signs and symptoms, lab. Diagnosis prophylaxis / prevention and chemotherapy.*
- Typhus fever : *(morphology of causative agent, clinical signs and symptoms, lab. Diagnosis prophylaxis / prevention and chemotherapy.*

B.Sc. Second year Semester III
Paper IX. Practical

1. Enumeration of microbes from: Indoor and outdoor environment
2. Bacteriological examination of drinking water:
   I. MPN
   II. SPC
3. Qualitative analysis of water :
   I. Presumptive
   II. Confirmed
   III. Completed test
4. Testing of (water & domestic sewage) for physicochemical parameters like chlorine, phosphate, nitrate and BOD.
5. Isolation of*E. coli* and identification by IMViC
6. Isolation of coliphages from sewage
7. Isolation enteric pathogens from domestic sewage (salmonella and shigella spp)

Paper X Practical

1. Demonstration of media for cultivation of pathogenic bacteria
   I. Mannitol salt agar.
   II. Wilson and Blair's medium
   III. Lowenstein- Jenson's medium
   IV. Corn- meal agar.
2. Staining techniques
   I. Acid fast staining (Demonstration)
   II. Blood staining (differential WBC count)
3. Hemoglobin examination
4. Isolation & study of normal flora of skin/ nose/ throat.
5. Agglutination tests: (Slide tests)
   I. Blood grouping
   II. Widal test
   III. RPR test.
6. Precipitation test: Demonstration.
   I. Single radial immunodiffusion
   II. Immuno electrophoresis.

B. Sc. Second year Semester IV
Paper XIII Practical

1. Determination of R: S ratio.
2. Demonstration of:
   I. Ammonification
   II. Nitrification
   III. Denitrification
   IV. Nitrate reduction
   V. Sulfate reduction.
3. Isolation & study of *Rhozobium*sp from root nodules of leguminous plants.
4. Isolation & study of *Azotobacter sp.* from soil.
5. Bacteriological analysis of milk:
   I. DMC
   II. MBRT
6. Isolation of microorganisms from common food items; curd/ bread/ pickles/ spoilt food.
7. Visit to waste treatment plants, dairies, food industries, agricultural universities.

Paper XIV Practical

1. Study bacterial pathogens:
   I. *Staphylococcus aureus*
   II. *Salmonella typhi*
   III. *Vibrio cholerae*
2. Isolation & Identification of *Candida albicans*
3. Demonstration of haemolysin& coagulase tests.
4. Determination of antibiotic resistance of bacteria.
5. Detection of specific antigen by ELISA (demonstration – Viral Disease)
6. Visits to related labs, hospitals & institutes.

(Chairman BOS)
25/04/2014
(Dr. Mohd Shakeel)

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO.ACAD/SU/Sci./B.Sc. & M.Sc. Syll./5/2015

It is hereby notified for information to all the concerned that, on the recommendation of the Faculty of Science the Academic Council at its meeting held on 30-05-2015 has accepted the **revised semester-wise syllabi as mentioned against their names in the Faculty of Science as under** :-

Sr. No.	Name of the Subject	Semester
[1]	B.Sc. Computer Science Degree Course	III & IV
[2]	B.Sc. Information Technology Degree Course	III & IV
[3]	B.C.A. Science Degree Course	III & IV
[4]	B.Sc. Animation Degree Course	III & IV
[5]	B.Sc. Bioinformatics Degree Course	III & IV
[6]	B.Sc. Computer Science [Optional]	III & IV
[7]	B.Sc. Information Technology [Optional]	III & IV
[8]	B.Sc. Computer Applications [Optional]	III & IV
[9]	B.Sc. Computer Maintenance [Optional]	III & IV
[10]	B.Sc. Environmental Science [Optional]	V & VI
[11]	B.Sc. Bio-Chemistry [Optional]	V & VI
[12]	B.Sc. Forensic Science Degree Course	V & VI
[13]	B.Sc. Industrial Chemistry [Optional]	V & VI
[14]	B.Sc. Electronics [Optional]	V & VI
[15]	B.Sc. Zoology [Optional]	V & VI
[16]	B.Sc. Microbiology [Optional]	V & VI
[17]	B.Sc. Instrumentation Practice [Optional]	V & VI
[18]	B.Sc. Statistics [Optional]	V & VI
[19]	B.A. Statistics [Optional]	V & VI
[20]	B.A. / B.Sc. Mathematics [Optional]	V & VI
[21]	B.Sc. Home Science Degree Course	V & VI
[22]	B.Sc. Textile Interior Decoration Degree Course	V & VI
[23]	B.Sc. Fishery Science [Optional]	V & VI
[24]	B.Sc. Dairy Science & Technology [Optional]	V & VI
[25]	B.Sc. Botany [Optional]	V & VI
[26]	B.Sc. Physics [Optional]	V & VI
[27]	M.Sc. Computer Science	III & IV
[28]	M.Sc. I.T.	III & IV

This is effective from the Academic Year 2015-16 & onwards as appended herewith.

All concerned are requested to note the contents of the circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.ACAD/SU/SCI./
2015/3761-4160
Date:- 16-06-2015.

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Director,
Board of College and
University Development.

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Copy forwarded with compliments to:-

1] The Principals, affiliated concerned colleges,
Dr. Babasaheb Ambedkar Marathwada University

Copy to :-

1] The Controller of Examinations,
2] The Director, [E-Suvidha Kendra], in-front of Registrar's Quarter,
Dr. Babasaheb Ambedkar Marathwada University,
3] The Superintendent, [B.Sc. Unit],
4] The Superintendent, [M.Sc. Unit],
5] The Programmer [Computer Unit-1] Examinations,
6] The Programmer [Computer Unit-2] Examinations,
7] The Record Keeper.

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S*/-160615/-

Revised Syllabus ofB.Sc. Third Year
[Microbiology]
Semester- V & VI

(optional)

(Effective from June 2015 – 2016 onwards)

put before
A.C.
7/3/15

DR BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Course Structure

Year	Semester	Paper number	Paper Title	Hours	Marks
B. Sc. Third	V	Paper-XV	Microbial Genetics	45	50
		Paper-XVI	Microbial Metabolism	45	50
		Paper-XVII	Practical	45	50
		Paper-XVIII	Practical	45	50
	VI	Paper-XIX	Recombinant DNA Technology	45	50
		Paper-XX	Industrial Microbiology	45	50
		Paper-XXI	Practical	45	50
		Paper-XXII	Practical	45	50
			Total	360	400

B.Sc. III rd Year, Microbiology

[Semester- V]

Paper XV- Microbial Genetics

Unit I : Properties of DNA and Gene expression (12)

- Molecular structure of DNA
- DNA as a genetic material: Experimental proof –
  i. Griffith and Avery, MacLeod and McCarty experiment
  ii. Hershey-Chase and experiments.
- Molecular properties of DNA – Melting. Breathing, Bending, flexibility, Novel structures, linking number, major and minor groove.

DNA Replication

- Semi conservative mode of DNA replication: Meselson and Stahl'sexperiment
- Mechanism, steps and process with enzymes involved in replication
- Post replication modification- Methylation (dam, dcm, hsd).

Unit II (11)

Gene expression

- Salient features of Genetic code.
- Biological expression of a gene: Protein synthesis : Transcription and Translations processes.
- Regulation of gene expression: Lac operon , Ara operon

Unit III: Genetic Mutations (11)

- Spontaneous mutation: Definition, causes, replica plating.
- Induced mutation: Types
  -Base pair substitution (transition and transversion)
  -Frameshift mutations (deletion and insertion)

- Missense mutation, nonsense mutations, silent mutation
- Genetic suppression- intragenic and extragenic
- Mutagenesis by physical and chemical agents

  Physical mutagenic agents: U.V. radiations, X rays

  Chemical mutations: Base modifiers: Nitrous oxide, Base analogue: 5 Bromo uracil, Agents producing distortion in DNA – Proflavin, Intercalating agents: ethidium bromide.

Unit IV: Bacterial Recombinations (11)

- **Transformation:** Definition, experimental proof, process of transformation, uptake of DNA, competence factor
- **Transduction:** Definition, Lederberg and Zinder 'U' tube experiment, Mechanism and process- generalized specialized and abortive transduction.
- **Conjugation :** Definition, Experimental proof Lederberg and Tatum experiment, Conjugation process,
- F, Hfr, F' factors.

[Semester- V]

Paper-XVI: Microbial Metabolism

Unit: 1 **(11)**

- Enzymes: Definition, properties, specificity, active site, activation of enzymes, Mechanism of action of enzymes (locks and key, induced fit, ping-pong)
- Nomenclature and classification of enzymes.
- Factors affecting catalytic activity of enzymes (pH, temperature ,enzyme concentration, substrate concentration ,metal ions, time)
- Michaelis-Menten equation : derivation and significance.
- Types of enzymes :extracellular, intracellular, constitutive and inducible.

Unit:II **(11)**

- Enzyme inhibition: Irreversible, reversible (competitive, uncompetitive, in competitive) and metabolic antagonism, feedback inhibition.
- Co-enzymes and respective enzymes. (NAD, FAD, Lipoic acid, Vitamin B12, Thiamine pyrophosphate)
- Elementary knowledge and uses of isoenzymes.
- Commercial uses of enzymes (any five) – (food, leather, textile, environment,
- pharmaceuticals and clinical)

Unit III **(11)**

- Definitions: Metabolism, anabolism, catabolism, free energy.
- Bioenergetics: chemical links between catabolism and biosynthesis, energy coupling through ATP and through pyridine nucleotides, Central role of ATP-ADP system.
- Modes of energy yielding metabolism : Definition and features of fermentation, Respiration and photosynthesis.
- Fermentation of carbohydrates:

- EMP, HMP, ED, Phospoketolase pathway (pentose , hexose) with structure.
- Alcoholic, homolactic, mixed acid, butanediol, butyric, acetone-butanol fermentations.

Unit IV **(12)**

- Aerobic respiration:
- RETC : location functions, components, redox carriers, oxidative phosphorylation artificial electron acceptors, bacterial cytochrome systems
- TCA cycle, glyoxylate cycle, anaplerotic sequences.
- Catabolism of saturated (16 carbon) and unsaturated fatty acids (16 carbon) by β Oxidation
- Degradation of proteins and amino acids: proteolysis, putrefaction.
- Transformation of amino acids: oxidation, reduction, decarboxylation, deamination (one example of each).
- Nucleic acid catabolism: DNA, RNA depolymerization, degradation of nitrogenous bases (mention end products without pathway)
- Biosynthesis of nucleotides: Purine and pyrimidine nucleotides, conversion of ribonucleotides to deoxyribonucleotides.

B.Sc. III rd year, Microbiology [Semester- V]

Practical paper – XVII

1. Isolation of total RNA from yeast.
   i) Purification of RNA by phenol extraction method.
   ii) Concentration of RNA by ethanol precipitation.
2. Hyperchromacity study of chromosomal DNA using UV -visible spectrophotometer
3. Isolation of spontaneous Lac mutant of *E coli* by Replica plating.
4. Effect of U.V. radiation (U.V. damage) on DNA and photo reactivation in *E coli.*
5. Study of Transformation in *E coli*
   a. Preparation of competent *E coli*
   b. Enumeration of transformed cells
   c. Determination of plasmid transfer efficiency
6. Isolation of coliphage from sewage.
7. Study of conjugation in *E coli* (Plate method)

Practical paper –XVIII

1. Preparation of buffers and reagents.
2. Study of enzymes: - α-amylase, caseinase, catalase, desulfurase, gelatinase, lecithinase, oxidase.
3. Effect of pH, temp, substrate concentration on α- amylase activity.
4. Demonstration of nitrate reduction
5. Demonstration of decarboxylation of amino acid.
6. Isolation of photosynthetic bacteria by column method
7. Primary screening for:
   i) Starch hydrolyzers.
   ii) Organic acid producers.
   iii) Antibiotic producers.

B.Sc. III Year [Semester-VI]

Paper- XIX: Recombinant DNA Technology

Unit:I **(11)**

- Recombinant DNA technology: definition, objectives of genetic engineering, tools used for cloning, steps in gene cloning.
- DNA manipulating enzymes: i) restriction endonucleases (types, nomenclature, recognition sequences, cleavage patterns with examples), ii) DNA ligase iii) alkaline phosphtase, iv) polynucleotide kinase v) reverse transcriptase.

Unit II: **(11)**

- Vectors: properties of good vector, cloning and expression vectors. (pBR322, pUC18), Bacteriophage vectors (improved λ vector), cosmids, YAC.
- Properties of good host (cloning organisms).
- Uptake of DNA (Calcium chloride treatment, electroporation, protoplast fusion, liposome).
- Selection of recombinant clones by blue script / white script screening.

Unit: III (11)

- Genomic library (construction and identification of desired clone).
- Probes (preparation &labeling) , its uses.
- PCR
- Nucleic acid and protein blotting techniques :
    - Southern blotting,
    - Western blotting,
    - Northern blotting.
- Colony hybridization
- DNA sequencing (Sanger method / dideoxy method)

Unit IV **(12)**

- Gene therapy (Somatic cell and germ line)
- Applications of genetic engineering
  - Agriculture-(Golden rice and Bt cotton)
  - Human and animal health (Interferon and HBV vaccine)
  - Industries (Strain improvement and recombinant proteins Insulin)
  - Environment(Super bug and Bioremediation using GEMS)
- Ethical issues of genetic engineering.

Semester VI Paper- XX Industrial Microbiology

Unit I : (11)

- Introduction to Industrial Microbiology, Historical events (any ten).
- Lay out of a fermentation Industry: Different units and departments and functions (stock, production and fermentation, Q.C and Q.A. and R & D, Packaging Importance of sterility maintenance and checking.
- I.P. and W.H.O. standards of sterility.
- Design of a fermentor, Types, (Single, multiple)
- Scale up of fermentation.

Unit II : (11)

- Primary and Secondary screening methods
- Preservation of industrially important Microbe (Serial subculture, overlaying mineral oil, soil stocks, lyophilisation, liquid nitrogen preservation)
- Strain improvement methods for increase in yield of product. (any one)
- Development of inoculum (Steps).
- Development of fermentation medium (Raw materials, nutrients, media formulation, pretreatment, sterilization, buffers, antifoam agents, cell lysates, precursors)
- Phage contamination and control

Unit III:

- Industrial fermentations (11)
    - Antibiotic – penicillin
    - Vitamin B12
    - L-Lysine (Direct method)

Unit: IV (12)

- Microbial production of
    - Ethyl Alcohol
    - Citric acid

Reference Books for B.Sc III rd Year Microbiology

1. Avinash & Kakoli Upadhay: MOLBIO , Himalaya Publications.
2. Barry J.M. & Barry F.M. Molecular Biology
3. Freifelder David : Microbial Genetics, Jones & Bartlett, Publications
4. Gardner Eldon , Simmon Michael & Sneustad Oeter: Principals of Genetics, John Wily & Sons, NEWYORK.
5. James D .Watson : Molecular Biology of the gene, W.A. Bejamin, inc.
6. Nilima Rajvaidya & D. Markendey: Genetical & biochemical applications of Microbiology, APH Publishing Co NEW DELHI.
7. A.H. Rose : Chemical microbiology-An introduction to microbial physiology, Butterworth World student, LONDON.
8. Campbell Peter N.& Smith Anthony D. : Biochemistry Illustrated, Churcill Livingstone, NEWYARK.
9. Deb A.C.: Fundamentals of Biochemistry, New central Book Agency, Calcutta.
10. Lehninger Alert L.: Principals of Biochemistry, CBS Publisher, DELHI.
11. Lehninger Alert L: Biochemistry , Kalyani Publisher NEW DELHI.
12. Moat Albert G. & Foster John W.: Microbial Physiology, John Wiley& Sons, Inc.
13. Moat A. G. Microbial Biochemistry.
14. Steinner R.F.: Life Chemistry- An Introduction to Biochemistry, D van Nostrand cc inc, LONDON.
15. Stryer Lubrt: Biochemistry, W.H. Freeman & Co. San Francisco.
16. T.Palmer: Understanding Enzymes .
17. Walker J.M. & Gingold A.D.: Molecular Biology & Biotechnology, Panima Publications NEW DELHI.
18. Sing B.D. : Biotechnology Kalyani Publisher, DELHI.
19. Joshi P. Genetic Engeneering and its applications Agro bios Jodhpur INDIA
20. Tikekar P.G. Practical Biochemistry for medical students, Purvi Pustak Kendra BOMBAY,
21. Jayaraman J. Laboratory manual in biochemistry: New age , International Publishers.
22. Plummer David : An Introduction To Practical Biochemistry,Tata Mac Grow Hill Books,Co -17
23. Chtwal Anand : Instrumental Methods –Chemical Analysis , Himalaya Publishing House .
24. Biss Swanger Hans : Practical Enzymology, Wiley –VCH VErlag Gmvh& co.
25. Prescott & Dumn: Industrial Microbiology, Mac Grow Hill Co Ltd.
26. Casida L.E. : Indusrtial Microbiology Willey Estern Ltd. NEW DELHI.
27. A.H. Patel : Industrial Microbiology , Mc Millan (India) Ltd. BOMBAY.
28. Strickberger M. : Genetics, Prentice Hall of India Pvt Ltd New Delhi.

- Amylase enzyme (fungal)

- Baker's yeast
- Biofertilizers (Azo-Rhizo. PSB) and Biopesticide production

Chairman
B. O. S.
Microbiology

B.Sc. III rd year, Microbiology [Semester- VI]

Practical papers XXI

1. Restriction digestion of lambda DNA
2. Isolation of *E. coli* chromosomal DNA.
3. Separation of *E coli* DNA by agarose gel electrophoresis.
4. Confirmation and estimation of DNA by diphenylamine
5. Ligation chain reaction
6. i) Study of DNA uptake in *E coli* using $Cacl_2$ treatment
   ii) Selection of recombinant clones on suitable medium.
7. Measurement of B-galactosidase activity of *E coli* / Yeast using ONPG
8. Demonstration of polymerase chain reaction (PCR)

Practical paper – XXII

1. Production, detection and estimation of ethanol using *S cerevisiae.*
2. Production and estimation citric acid by *Aspergillus spp*
3. Production of alpha-amylase by *Aspergillus / Bacillus spp.*
4. Identification of fermentation product by paper chromatography and thin layer chromatography – Lysine and Citric acid.
5. Separation of proteins by using agarose gel electrophoresis.
6. Microbiological Assay of penicillin.
7. Study tour and report submission

FACULTY OF SCIENCE

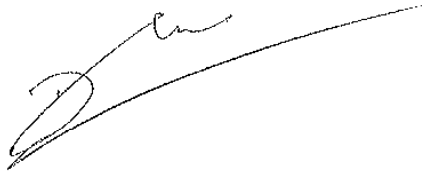
B.Sc. (Third Year)(Fifth Semester) Examination

MICROBIOLOGY

Paper XV- Microbial Genetics

Time-2 Hours *Maximum Marks-50*

Q1-	Question on unit-1	Marks-10
	Or	
	Question on unit-1	
Q2-	Question on unit-2	Marks-10
	Or	
	Question on unit-2	
Q3-	Question on unit-3	Marks-10
	Or	
	Question on unit-3	
Q4-	Short notes on unit -4	Marks- 10
Q5-	Multiple choice 10 questions on all units	Marks -10



FACULTY OF SCIENCE

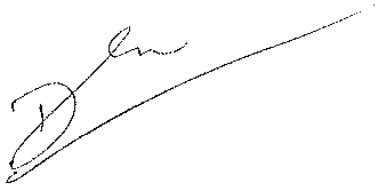
B.Sc. (Third Year) (Fifth Semester) Examination

MICROBIOLOGY

Paper-XVI: Microbial Metabolism

Time-2 Hours *Maximum Marks-50*

Q1-	Question on unit-1 Or Question on unit-1	Marks-10
Q2-	Question on unit-2 Or Question on unit-2	Marks-10
Q3-	Question on unit-3 Or Question on unit-3	Marks-10
Q4-	Short notes on unit -4	Marks- 10
Q5-	Multiple choice 10 questions on all units	Marks -10



FACULTY OF SCIENCE

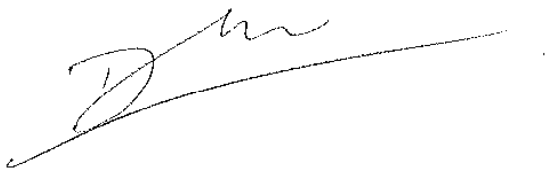
B.Sc. (Third Year) (Sixth Semester) Examination

MICROBIOLOGY

Paper- XIX: Recombinant DNA Technology

Time-2 Hours *Maximum Marks-50*

Q1-	Question on unit-1 Or Question on unit-1	Marks-10
Q2-	Question on unit-2 Or Question on unit-2	Marks-10
Q3-	Question on unit-3 Or Question on unit-3	Marks-10
Q4-	Short notes on unit -4	Marks- 10
Q5-	Multiple choice 10 questions on all units	Marks -10



FACULTY OF SCIENCE

B.Sc. (Third Year) (Sixth Semester) Examination

MICROBIOLOGY

Paper- XX Industrial Microbiology

Time-2 Hours *Maximum Marks-50*

Q1-	Question on unit-1 Or Question on unit-1	Marks-10
Q2-	Question on unit-2 Or Question on unit-2	Marks-10
Q3-	Question on unit-3 Or Question on unit-3	Marks-10
Q4-	Short notes on unit -4	Marks- 10
Q5-	Multiple choice 10 questions on all units	Marks -10