

बिलासपुर विश्वविद्यालय

बिलासपुर (छत्तीसगढ़)



पाठ्यक्रम

विज्ञान - प्रकाश
निम्न स्तर पाठ्यक्रम
रसायन विज्ञान (पूर्व/अंतिम)
माइक्रोबायोलॉजी

परीक्षा : 2014

:: प्रकाशक ::

कुलसचिव बिलासपुर विश्वविद्यालय

बिलासपुर (छत्तीसगढ़)

ORDINANCE NO 39

Master of Science Examination

1. The examination for the degree of Master of Science consist of two parts
 - (A) The Previous examination and
 - (B) The Final Examination.
2. A candidate who after obtaining the degree of Bachelor of science the University or an examination of any statutory University in any statutory University in India which has been recognised by they University as equivalent to B.Sc. degree of the University and has completed a regular course of study in the teaching department of the University in the subject in which he offers himself for examination for one academic year shall by admitted to the previous examination for the degree of master of Science.
 Provided however every candidate shall offer for the Previous Examination one of the subjects offered by his/her B.Sc. Degree.
 Provided further (i) for admission of M.Sc. Previous/Final (Microbiology) and candidate must have offered Maths as one of the subject in B.Sc. (ii) for admission in Previous/Final (Microbiology) preference will be given to those candidates who offered Maths as one of their subject in B.Sc.
3. A candidate who after passing the M.Sc. previous Examination of the University has completed a regular course of study for one academic year in a teaching department of the University or in a College affiliated to the University shall be admitted to the Final Examination for the degree of Master of Science in the subject in which he/she has passed the Previous examination.
 A Candidate who has passed the previous examination for the degree of Master of Science of another University may also be admitted to the final Examination for the degree of Master of Science after obtaining necessary permission from the Kulpati, provided that he offered for his previous Examination a course of study of an equivalent standard with almost identical syllabus as is required for the Previous Examination of this University, and has attended a regular course of study for one academic year in a College affiliated to the University teaching department of the University.
4. The examination shall be partly by meant of paper and partly practical including sessional, except in the case of Mathematics where

- the examination shall be paper only.
5. Besides regular students and subject to other compliance with his ordinance, ex-students and non collegiate candidates shall be eligible for admission to the examination as per provision or ordinance No. 6 relating to Examination shall be paper only.
 Provided that non- collegiate candidate shall be permitted to offer only such subjects/papers as are taught to the regular students at any of University teaching Department of College.
 6. The Subject of the Examination shall be of the following :

(i) Mathematics	(ii) Physics
(iii) Chemistry	(iv) Zoology
(v) Botany	(vi) Geology

 A candidate who has passed the M.Sc. Examination of the University shall be allowed to present himself for the M.Com. Examination in any one of more of the optional papers in that subject not taken by him at the said examination and is successful with be given a certificate to that effect.
 7. From the session 1986 - 87 for the Previous Examination, candidate must obtain for a pass atleast 20% in each theory and Practical and 36% of the aggregate marks in the Theory and Practical separately in each examination. The above provision of 20% in each paper shall be applicable for Final Examination from the academic session of 1987-88.
 8. No division will be assigned on the result of the Previous Examination the division in which a candidate is placed shall be determined on the basis of aggregate of marks obtained in both. the M. Sc. Previous and M.Sc. Final Examination.
 9. Successful candidates who obtain 60% or more of the aggregate marks shall be placed in the first Division, those obtaining less than 60% but not less 48% in the second Division and all other success full candidate obtaining less than 48% in the Third Division.
 10. Candidates who gave passed the M.Sc Examination of the University in any subject in Third or Second Division and desire to appear at the M.Sc. Examination in the same subject for improving division without attending a regular course of study in a College affiliated to the University or in a Teaching Department of the University be allowed to appear at the aforesaid examination an non-collegiate student on the following conditions.

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एम. एस. सी. (पूर्व/अंतिम) माइक्रोबायोलॉजी पाठ्यक्रम

- (i) There shall be only two Division for such candidates the First division and second Division. The Marks required for obtaining these division shall be the same as prescribed in the ordinance i.e. examinees who are successful in Final of the Examination, and have obtained 60% or more aggregate of the marks in Previous and Final Examination taken together shall be placed in the First Division and Examinees who are successful in Final Examination and have obtained less than 60% but not less than 48% of aggregate marks in previous and Final examination taken together shall be placed in the Second Division.
- (ii) The result of the candidates obtaining less than 48% of the aggregate marks in previous and Final Examination taken together shall not be declared.
- (iii) Candidates shall have the option to appear at both the previous and final examination in one and the same year and for being successful at the examination, the candidates shall obtain 48% of the aggregate marks.
- Provided that such candidates who opt to appear in previous and final examination separately shall have to obtain minimum aggregate required for the previous examination but he will have to obtain at least 48% in the aggregate of previous and final examination taken together or else his result will be cancelled.
- (iv) The syllabus for the examination shall be same as prescribed for the year in which the examination is held.
- (v) Not more than to attempt shall be allowed to such a candidate. Failure of non-appearance at the examination after per permission has been accorded by the University shall be counted an attempt. provided however such candidates who to appear at the previous and final examination separately will be allowed only one attempt of the previous examination and two attempts as the final examination.
- (vi) Candidates who wish to avail the opportunity given in foregoing paraes will have to apply for permission as required in the Ordinance relating to admission of non-collegiate students to the University examination along with registration fee.
- (vii) In case, a student improves his division under provision of this para, the fresh Degree will be issued after cancelling his first Degree.

M.SC. (PREVIOUS) MICROBIOLOGY W.E.F. 2004-05

There will be four theory and two practical examination. Each theory and practical examination will be of 100 marks.

A-1553 PAPER I - BACTERIOLOGY

M.M. : 100

- UNIT-I Morphology and ultra structure of bacteria**-morphological types-cell walls of archaebacteria, gram negative-gram positive eubacteria-eukaryotes L-forms-cell wall synthesis, antigenic properties-capsule-types, composition and function, cell membranes-structure-composition-properties.
- UNIT-II Structure function of flagella-cilia-pili-gas vesicles**-chromosomes, carboxysomes-magnetosomes and phycobolismes-nucleoid-cell division-spores.
- UNIT-III Reserve food materials**-polyhydroxybutyrate-polyphosphosphate granules-oil droplets-cyanophycin granules and sulphur inclusions.
- UNIT-IV Cultivation of bacteria-aerobic-anaerobic-shaker-still**, nutritional types, culture media used, growth curve, generation time-growth kinetics-asynchronous-synchronous-batch continuous culture, measurement of growth and factors affecting growth, control of bacterial physical and chemical agents-preservation methods.
- UNIT-V Classification of micro organisms-introduction-Haeckel's three kingdom concept**-Whittacker's five kingdom concept-three domain concept of Carl Woese, Basis of microbial classification and salient features of bacteria according to the Bergey's manual of determinative bacteriology cyanobacteria, prochlorons and cyanelles.

Text Books:

1. A.J. Salle, Fundamental Principles of Bacteriology.
2. Brock, T.D., Madiqan M.T. Biology of Microorganisms. Prentice Hall Int. Inc.
3. Pelczar M.J. Chan E.C.S. Kreig N.R. Microbiology, Mc Graw Hill

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PAPER II BIOCHEMISTRY

M.M. : 100

UNIT - I Composition of living matter, biochemistry of bacterial, animal and plant cell, specialized components of microorganisms and their structure and function.

UNIT-II Enzymes as biocatalysts, enzyme classification specificity, active site activity unit, isozymes. Enzyme kinetics. Michaelis - Menton equation for simple enzymes, determination of kinetic parameters, multistep reactions and rate limiting steps. enzyme inhibition, allosterism, Kinetic analysis of allosteric enzymes, principles of allosteric regulation.

UNIT-III Structural features and chemistry of macromolecules : nucleic acid, proteins, carbohydrates and lipids and biomolecules such as antibiotics, pigments and other secondary metabolites.

UNIT-IV Bioenergetics and strategy of metabolism; flow of energy through biosphere, strategy of energy production in the cell, oxidation reduction, coupled reactions and group transfer, ATP production, structural features of biomembranes, transport, free energy and spontaneity of reaction, G , G° , G and equilibrium, basic concepts of acids, base pH and buffers,

UNIT-V Cell metabolism : catabolic principles and break down of carbohydrates, lipids, proteins and nucleic acids, biosynthesis of macromolecules, hormone regulation of metabolism, vitamins and their role as coenzymes.

TEXT BOOKS-

1. Biochemistry, Stryer 5th edition W.H. Freeman 2001.
2. Principles of Biochemistry Lehniger 3rd Edition by Nelson and Cox (Worth) 2000. Publishers.

PAPER III - MOLECULAR BIOLOGY

M.M.: 100

UNIT-I Nucleic acids as genetic information carriers : experimental evidence. DNA structure : historical aspects and current concepts, melting of DNA, DNA replication : general principles various modes of replication, isolation and properties of DNA polymerases, proof reading, continuous and discontinuous synthesis. Asymmetric & dimeric nature of DNA polymerase III and simultaneous synthesis of leading and lagging strands. DNA

polymerase, exonuclease activity in eukaryotic DNA polymerases, Superhelicity in DNA, linking number, topological properties, mechanisms of action of topoisomerases.

UNIT-II Initiation of replication of single stranded DNA. Construction of replication fork in test tube. Retroviruses and their unique mode of DNA synthesis. Relationship between replication and cell cycle. Inhibitors of DNA replication (blocking precursor synthesis, nucleotide polymerization, altering DNA Structure). DNA damage and repair, types of DNA damage (Deamination, oxidative damage alkylation, pyrimidine dimers). Repair pathways-methyl-directed mismatch repair, very short patch repair, nucleotide excision repair, base excision repair, recombination, repair, SOS system.

UNIT-III Structural features of RNA (tRNA, rRNA and mRNA) and relation to function. Initiator and elongator class of tRNA, ribosome binding site on mRNA and corresponding site on rRNA, peptidyl transferase activity of 23S rRNA. **Transcription :** General principles, basic apparatus, types of RNA polymerases, steps : initiation, elongation and termination, inhibitors of RNA synthesis. Polycistronic and monocistronic RNAs. Control of transcription by interaction between RNA polymerases and promoter regions, use of alternate sigma factors, controlled termination : attenuation and antitermination.

UNIT-IV Regulation of gene expression: operon concept, catabolite repression. Instability of bacterial RNA, positive and negative regulation, inducers and corepressors. Negative regulation- E. coli lac operon; positive regulation- E coli ara operon; regulation by attenuation- his and try operons; DNA binding proteins, enhancer sequences and control of transcription. Identification of protein binding sites on DNA. Global regulatory responses; heat & shock response, stringent response and regulation by small molecules such as PP GPP and CAMP, regulation of rRNA and tRNA synthesis.

Maturation and processing of RNA :- methylation, cutting and trimming of rRNA capping polyadenylation and splicing of mRNA cutting and modification of tRNA degradation system catalytic RNA, Group I and group II intron splicing, RNase P.

UNIT-V Basic features of the genetic code. Protein synthesis : steps details of initiation, elongation & termination role of various factors in the above steps inhibitors of protein synthesis. signal hypothesis. In vitro transcription translation system.

PAPER - IV ENVIRONMENTAL MICROBIOLOGY

A - 1556 M.M. : 100

- UNIT-I Aerobiology** - Droplet nuclei, aerosol, assessment of air quality - solid - liquid - impingement methods - Brief account of air borne transmission of microbes - viruses - bacteria and fungi, general account of air borne diseases and their preventive measures.
- UNIT-II Aquatic microbiology** - Water ecosystems - types - water (ponds lakes streams) - marine habitats (estuaries, mangroves, deep sea, hydrothermal vents, corareefs). Zonation of water ecosystems - upwelling - eutrophication - food chain. Potability of water, microbial assessment of water quality - water purification - brief account of major water borne diseases and their control measures.
- UNIT-III Soil Microbiology** - Classification of soils - physical and chemical characteristics, microflora of various soil types (Bacteria and nematodes in relevance to soil types; rhizosphere - phyllosphere - brief account of microbial interactions symbiosis - mutualism - commensalism - competition - amensalism - synergism - parasitism - predation. biogeochemical cycles - carbon, nitrogen - phosphorus and sulphur, biofertilizers - biological nitrogen fixation - nitrogenase enzyme - nif genes; symbiotic nitrogen fixation - (Rhizobium, Frankia) - non symbiotic microbes Azotobacter - Azospirillum (vascular arbuscular mycorrhizae-VAM) ecto, endo, ectendomycorrhizae-rumen microbiology.
- UNIT-IV Waste Treatment:** Wastes - types solid and liquid waste, characterisation of solid liquid waste treatment - physical chemical, biological aerobic - anaerobic - primary - secondary - tertiary; solid waste treatment - saccharification - gasification - composting, Utilization of solid waste - food (SCP, mushroom, yeast): fuel (ethanol, methane) fertilizer (composting)
- UNIT-V Positive and negative roles of microbes in environment** - biodegradation of recalcitrant compounds - lignin - pesticides; bioaccumulation of metals and detoxification; biopesticides; biodeterioration - of paper - leather, wood, textiles - metal corrosion - mode of deterioration - organisms involved - its disadvantages - mode of prevention. GMO and their impact.

SC. (PREVIOUS) PRACTICAL - PAPER-I GENERAL MICROBIOLOGY

Microscopy - Microscope and its operations - components - Microscope adjustments - Light sources - microscopic measurements - calibration; Types of microscope available - theory. Observation of various uses of microbes under phase contrast, dark field and fluorescence.

Preparation of glassware - washing - sterilization techniques - wet at - dry heat - filter types - laminar flow chamber types - CDC - safety etc.

Preparation of culture media - nutritional needs of microbes - hydrated - selective - differential - autotrophic - heterotrophic. Culture techniques - adjustment of pH - buffers - pure culture techniques - preparation of starts. subculturing.

Microbial growth measurement - cell count - turbidity measurement - percentage transmission. Optical Density - serial dilution - standard plate count.

Morphological nutritional and cultural characteristics of bacteria and identification of microbes; types of dyes - preparation - staining techniques - simple - Gram's - capsule - negative - flagella. spore and nuclear.

Reference -

Experimental Microbiology Laboratory guide, Robert, C. Coss, Kalyani Publishers, Ludhiana.

Microbiology - A Laboratory manual - J.G. Cappucino, N. Sherman, Benjamin/Cummings-1996.

Handbook of Microbiological Media - Himedia.

Reference -

Experimental Microbiology Laboratory guide, Robert C. Coss, Kalyani Publishers Ludhiana.

Microbiology - A Laboratory manual - L.G. Cappucino N. Sherman, Benjamin/Cummings-1996.

Handbook of Microbiological Media - Himedia.

M.Sc. (PREVIOUS) PRACTICAL - PAPER-I ANALYTICAL BIOCHEMISTRY

- 1) Measurement : criteria of reliability precision, accuracy, sensitivity, specificity.
- 2) Laboratory rules and safety regulation first aid.
- 3) Principles of colorimetry : verification of Beer's law, estimation of a selected protein, finding out I_{max} , relation between I.D. and percentage transmission. isolation and quantification of DNA from microorganism or other sources.
- 4) pH, pK, Henderson-Hasselbach equation, preparation of buffers.
- 5) Separation of amino acids by paper chromatography
- 6) Isolation of phospholipids from liver and their separation by thin layer chromatography.
- 7) Separation of haemoglobin and blue dextran by gel filtration.
- 8) Ion exchange chromatography : CM cellulose and DEAE cellulose.
- 9) Cell fractionation into nuclear, mitochondrial and cytoplasmic fractions; estimation of marker enzymes.
- 10) Qualitative estimation of proteins, carbohydrates and liquids.

PRACTICAL - II PAPER II : MOLECULAR BIOLOGY

1. Single colony isolation and checking genetic markers.
2. Spontaneous and induced mutations - isolation of antibiotic resistant.
3. Preparation of aceto-carmin, aceto-orcin and feulgen stains.
4. Preparation of root tip squash of *Allium sativum*/*Allium cepa*/vicia faba and *Rhoeo discolor*.
5. Study of polytene chromosome in chironomous or *Drosophila* larvae.
6. Karyotypic study of plant and human chromosomes.
7. Use of chemical mutagens, isolation of mutants.

Environmental Microbiology.

1. Isolation of bacteria from air and its biochemical activities.
2. a. Bacterial analysis of water & waste water.
b. Potability of water.
c. Presumptive coliform test.
3. Isolation of rhizobia from root nodules.
4. Effect of heavy metal on the growth of Th ?

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M.Sc Final (MICROBIOLOGY)

2005 - 06

There will be four theory and two practical examination. Each theory and practical examination will be of 100 Marks.

M.Sc. Final (Microbiology)

Paper - I

Time : 3 hrs.

Marks - 100

FUNDAMENTALS OF IMMUNOLOGY

Unit 1 : Immune System and Immunity History of Immunology; structures, composition and functions of cells and organs, involved in immune system; host parasite relationships; microbial infection: virulence and host resistance; immune responses - innate Immunity, acquired Immunity, Immunohaematology - blood groups, blood transfusion and Rh incompatibilities.

Unit 2: Antigen and Antibodies Antigens - structure and properties - types - Iso; and allo haptens, adjuvants - antigen specificity vaccines and toxoids. Immunoglobulins - structure - heterogeneity - types and subtypes properties (Physico Chemical and Biological) : Properties and functions of complement components; Complements pathways and biological consequences complements activation.

Unit 3: Antigen - Antibodies Reactions In vitro methods - agglutination, precipitation, complement fixation, immunofluorescence, ELISA radio Immunoassays; In vivo Methods: Skin tests and immune complex tissue demonstrations application of these methods in diagnosis of microbial diseases.

Unit 4: Major Histocompatibility Complex and Tumor Immunology. Structure and functions of MHC and the HL - A system. Gene regulation and Ir - genes. HL - A and tissue transplantation - tissue typing methods for organ and tissue transplantation in humans; graft versus host reaction and rejection; autoimmunity, Theories, mechanism and diseases with their diagnosis; Tumor immunology tumorspecific antigens, Immune responses to tumors, immunodiagnosis of tumors - detection of tumor markers alpha foetal proteins, carcinoembryonic antigen etc.

Unit 5: Hypersensitivity Reaction Antibody mediated - type 1. Anaphylaxis; type II. Antibody dependend cell cytotoxicity; type III, Immune complex mediated reactions; type IV Cell mediated hypersensitivity reactions. The respective diseases

Immunological, methods of their diagnosis. Lymphokines and cytokines

Text Books

1. Roitt I.M. (1998) Essential Immunology Elsevier. Blackwell, Scientific, Publishers, London.
2. Kuby (1994) Immunology II edition, W.H. Freeman and company, New York.
3. Klaus D. Elger (1996) Immunology - Understanding of Immune system, Wiley - Liss NY.
4. Topley & Wilson's (1995) Text book on principles of Bacteriology Virology and Immunology IX. Edition (5 Volumes) Edward Arnold, London.

Paper II A-1558

MEDICAL MICROBIOLOGY

Time : 3 hrs.

M.M. 100

- Unit 1 Early discovery of pathogenic micro-organisms :**
Development of bacteriology as scientific discipline : Contributions made by eminent scientists. Classification of medically important micro-organisms; Normal microbial flora of human body. role of the resident flora; normal flora and the human host.
- Unit 2 Establishment, spreading, tissue damage and anti-phagocytic factors; mechanism of bacterial adhesion colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts. Role of aggressins. depolymerising enzymes. organotropisms, variation and virulence**
- Unit 3 Classification of pathogenic bacteria.** Staphylococcus. Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium Non sporing: Anaerobes, Organisms belonging to Enterobacteriaceae, Vibrios, Non fermenting gram negative bacilli Yersinia; Haemophilus; Bordetella Brucella; Mycobacteria, Spirochaetes, Actinomycetes; Rickettsiae, Chlamydiae.
- Unit 4 General properties of Viruses Structure & general account on replication. Viruses host interactions structure and pathogenicity of pox viruses Herpes virus, Adeno viruses: Picarino Viruses, Orthomyxo Viruses; Paramyxoviruses; Arboviruses, Rhabdoviruses, Hepatitis Viruses; Oncogenic Viruses; Human Immunodeficiency viruses (AIDS). Dermatophytes Dimorphic fungi Opportunistic fungal pathogens. Description and Classification**

of Pathogenic fungi and their laboratory diagnosis.

- Unit 5.** Laboratory control of antimicrobial therapy; various methods of drug susceptibility, testing antibiotic assay in body fluids. Brief account on available vaccines and schedules: passive prophylactic measures; Nosocomial infection, common types of hospital infections and their diagnosis and control.

Reference

1. Text of Microbiology R. Ananthanarayanan and C.K. Jayaram Panicker.

PAPER III

MICROBIAL PHYSIOLOGY AND DEVELOPMENT

Time 3 Hrs.

M.M. 100

- Unit 1 Basic aspects of bioenergetics - entropy - enthalpy - electron carriers artificial electron donors - inhibitors - uncouplers - energy bond - phosphorylation.**
- Unit 2 Brief account of photosynthetic and accessory pigments - chlorophyll - bacteriochlorophyll - rhodopsin - carotenoids - phycobiliproteins, Carbohydrates - anabolism autotrophy - oxygenic - anoxygenic - photosynthesis - autotrophic generation of ATP; Fixation of CO₂ - Calvin cycle - C3 - C4 - Pathway Chemolithotrophy Sulphur - Iron - Hydrogen - Nitrogen Oxidation, Methanogenesis.**
- Unit 3 Respiratory metabolism - Embden mayer HPLF pathway - Entner Doudroff pathway, glyoxalate pathway - krebs cycle - oxidative and substrate level phosphorylation reverse TCA cycle - gluconeogenesis Pasteur effect: fermentation of carbohydrates - homo and heterolactic fermentation.**
- Unit 4 Assimilation of nitrogen - dinitrogen - nitrate nitrogen - ammonia synthesis of major amino acids - polyamines: Synthesis polysaccharides - peptidoglycan - biopolymers as cell component cell division endospore - structure - Properties - germination.**
- Unit 5 Microbial development. sporulation and morphogenesis. hyphae vs yeast forms and their significance, Multicellular organization of selected microbes Dormancy.**

Text Book

1. Caldwell. D.R. 1995, Microbial Physiology and metabolism, Brown publishers.
2. Moat A.G. & Foster J.W. 1999. Microbial Physiology Wiley.
3. Stainer RY. Ingraham J.L. Wheelis, M.L, Painter PR (1986) Gen-

eral Microbiology, Macmillan Education Ltd. London.

4. Brum Y. V. and Sbkrmkts, L.J. 2000. Prokaryotic Development
ASM press.

PAPER - IV

MICROBIAL TECHNOLOGY

Time 3hrs ~~4587~~ ~~AM-1619~~ M.M.100

- Unit 1** Biotechnological innovations in the chemical industry.
biocatalyst in organic chemical synthesis, efficiency of growth
and product formation, growth stoichiometry, maintenance energy
requirement and maximum biomass yield, P/O quotients
metabolite overproduction and growth efficiency.
- Unit 2** Shake flask, stirred tank airlift fermenter, fed batch, continuous
and immobilised, cell reactor, Large scale production.
- Unit 3** Metabolic pathways and metabolic control mechanism, industrial
production of citric acid, enzymes, ethanol, acetic acid,
production of antibodies, Steroids.
- Unit 4** Biofertilizers, biopesticides, mushroom production, fermented
food beverages, Biopolymers, Bioremediation.
- Unit 5** Industrial strains. Strategies for selection and improvement.
maintenance containment of recombinant organisms, large scale
production using recombinant micro-organisms Product recovery.

Text Books

1. Biotechnological innovations in chemical synthesis. BIOTOL.
Publisher. Butterworth - Heinemann.
2. Industrial Microbiology G. Reed (editor), CBS publishers (AVI
Publishing Company).
3. Biology of Industrial microorganisms. A.L. Demain.
4. Genetics and biotechnology of industrial microorganisms
C.L. Hershnergev, S.W. Queener and Q. Hegeman, publisher
Americans Society of Microbiology. Ewesis et al. 1998
Bioremediation principles McGraw Hill,

M.Sc.Final (Microbiology)
Practical - I

(Fundamentals of Immunology & Medical Microbiology)

Time: 5 hrs.

M.M.100

1. One exercise based on major practical noted as under- 20
 - (i) Isolation of normal micro-organisms of human skin.
 - (ii) Demonstration of Antibody response against given infectious disease.
 - (iii) Isolation of micro-organism from a given infectious disease.
 - (iv) Isolation of micro-organism from mouth saliva.
 - (v) To perform ag-ab interaction by double diffusion technique.
 - (vi) Demonstration of ELISA-TEST.
2. An exercise based on minor practical noted as under -10
 - (i) Performance of RPR test for diagnosis of syphilis.
 - (ii) Demonstration of serodiagnosis of enteric fever (Widal test)
 - (iii) Demonstration of lymphocyte sub population.
 - (iv) Separation & characterization of lymphocytes from blood.
 - (v) Isolation of pure cultures & preservation techniques.
 - (vi) Different staining technique - simple Gram's staining, Leishman's staining, special staining methods to demonstrate granules, capsules & spores.

An exercise based on the following

10

Performed experiments :-

- (i) Amino acid, hemoglobin & other molecules separation through gel electrophoresis or paper chromatography.
- (ii) Immunodiffusion.
- (B) Chart showing - 10

Any fungal, viral, bacterial diseases MHC, development of lymphocytes, Immunoglobulins, (Synthesis/diversity) Monoclonal - antibodies, Ag-Ab interaction, complement, Th, TC cell

Spotting

20

Viva

10

Sessional Marks.

20

Total Marks. 100

8

M.Sc. Final (Microbiology)**Practical - II****(Microbial Physiology & Microbial Technology)**

Time: 5hrs.	M.M. 100
1. One exercise based on major practical noted as under -	20
(i) Separation of photopigments through paper chromatography.	
(ii) Demonstration of O ₂ evolution during microbial photo-synthesis.	
(iii) Detection of antimicrobial activity of various excrudes/products.	
(iv) Isolation & identification of microorganism of industrial importance	
(v) Assay of enzyme activity in micro organism.	
(vi) Glucose fermentation demonstration by microorganism (such as by yeast).	
2. An exercise based on minor practical noted as under	10
(i) Immobilization of cells.	
(ii) Detection of organic acid production by microorganisms.	
(iii) Amylase production test.	
(iv) Casein hydrolysis test.	
3. An Exercise based on the following	10
(A) Performed experiments -	
(i) Qualitative measurements & separation of biomolecules, e.g. amino acid. enzymes.	
(ii) IMVIC test.	
(iii) Catalase test.	
(B) Chart showing -	10
Photophosphorylation, Calvin cycle, C4 pathway, Kreb's homo & heterolactic fermentations, continuous cultures, mashroom production, Bioremediation stirred tank, air lift fermenter, production of antibodies.	
4. Spotting	20
5. Viva	10
6. Sessional Marks	20
Total Marks -	100