लोक सेवा आयोग

नेपाल स्वास्थ्य सेवा मेडिकल ल्याव टेक्नोलोजी समूह, माइक्रोवायोलोजी उपसमूह, सातौं (७) तहको माइक्रोवायोलोजिष्ट पदको खुला र आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

पाठ्यक्रमको रुपरेखा :– यस पाठ्यक्रमको आधारमा निम्नानुसार दुई चरणमा परीक्षालिइने छ :

प्रथम चरण :– लिखित परीक्षा — पूर्णाङ्क :– २००
द्वितीय चरण :– सामूहिक परीक्षण र अन्तर्वार्ता — पूर्णाङ्क :– ४०

प्रथम चरण – लिखित परीक्षा योजना (Examination Scheme)

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्याxअङ्कभार	समय
प्रथम	**माइक्रोवायोलोजी**	१००	४०	वस्तुगत बहुवैकल्पिकप्रश्न (MCQs)	१००x१ = १००	१ घण्टा १५ मिनेट
द्वितीय		१००	४०	विषयगत (Subjective)	१०x१०= १००	३ घण्टा

द्वितीय चरण

विषय	पूर्णाङ्क	परीक्षा प्रणाली	समय
सामूहिक परीक्षण (Group Test)	१०	सामूहिक छलफल (Group Discussion)	३० मिनेट
व्यक्तिगत अन्तर्वार्ता	३०	मौखिक	-

द्रष्टव्य :

१. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।
२. प्रथम पत्र र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
३. वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरुको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टापनि गरिने छैन ।
४. बहुवैकल्पिकप्रश्नहरु हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
५. विषयगत प्रश्नहरुको हकमा तोकिएको अंकको एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरु (Short notes) सोध्न सकिने छ ।
६. द्वितीय पत्रमा -विषयगत प्रश्न हुनेका हकमा) प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरु हुनेछन् । परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरुको उत्तर सोही खण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ ।
७. यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भएतापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरु परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएकावा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्क्रममा परेको सम्झनु पर्दछ ।
८. प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
९. यस भन्दा अगाडि लागु भएका माथि उल्लेखित सेवा, समूहको पाठ्यक्रम खारेज गरिएको छ ।
१०. पाठ्यक्रम लागू मितिः **आ.व. २०७७-७८ मा प्रकाशित विज्ञापन देखि लागू ।**

लोक सेवा आयोग

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प्रथम र द्वितीयपत्र :– माइक्रोवायोलोजी

Section A - 20% Marks

1. **General Microbiology**
   - 1.1 **Historical development of Microbiology.**
     - 1.1.1 Modern concept of classification of microorganisms (nomenclature).
     - 1.1.2 Prokaryotic and Eukaryotic organisms.
     - 1.1.3 Germ theory of diseases, Spontaneous generation theory.
     - 1.1.4 Opportunistic and pathogenic organisms.
     - 1.1.5 Host Parasite interaction, Microbial interactions, and mechanism of infection
   - 1.2 **Biohazards and Bio-safety in Microbiology:** Basic concept on biohazard and bio-safety. Universal precaution. Laboratory waste products and disposal.
   - 1.3 **Sterilization Techniques:** Principle and procedure of various sterilization methods - Physical and mechanical (dry heat, moist heat, radiation and filtration, and incineration) Chemical sterilizer. Biological indicator
   - 1.4 **Staining Techniques:** Various staining techniques and principle and uses (types, forms, composition, selection and uses). Preparation and use of different stains in bacteriology laboratory: Grams stain, ZN stain, Albert stain, Spore stain, Capsule stain, Flagella stain
   - 1.5 **Preparation and use of different media** for bacterial and fungal isolation & identification
   - 1.6 **Types and Classification of antibiotics:** Antimicrobial susceptibility testing. Disc diffusion technique. Mechanisms of Action of Antibiotics and Bacterial Resistance to Antibiotics

Section B - 30% Marks

2. **Bacteriology**
   - 2.1 Classification, nomenclature and characteristic of major groups of bacteria.
   - 2.2 Pathogenic, nonpathogenic [Normal bacterial flora (Commensal)]/opportunistic bacteria.
   - 2.3 **Physiology and Growth of Medically Important Bacteria:** Bacterial reproduction, Growth of microorganism, Bacterial physiology and factors affecting the microbial growth: Nutrition (source of carbon, nitrogen, mineral and other sources of vitamin), Temperature, Water activity, Salinity (osmotic effect and electrolytes), pH, Gases (aerobic, anaerobic, facultative anaerobic, micro-aerophilic, carbon dioxide), Growth curve. Various culture media (types, forms, composition, selection and uses), Various culture techniques.
   - 2.4 **Anaerobic Culture**: Factors affecting anaerobic culture, Various media and techniques of anaerobic culture. Inoculation, isolation and identification of anaerobic microorganisms.
   - 2.5 **Metabolism and Metabolic Product of Medically Important Microorganisms.** Nutritional types. Carbon metabolism-general concept of glycolysis and TCA cycle. Biochemical properties of microorganisms. Various metabolic product and identification.

2.6 **Morphology, Metabolism, Isolation, Identification of:**

2.6.1 Gram Positive cocci: Aerobic: Micrococcus spp, Staphylococcus spp. Streptococcus spp; Anaerobic: Peptococcus spp., Peptostreptococcus spp.

2.6.2 Gram Negative Aerobic cocci: Neisseria spp.

2.6.3 Aerobic non-spore forming gram positive bacilli: Bacillus spp., Corynebacterium spp., Actinomyces pyogenes, Nocardia spp., Mycobacterium spp: pathogenic Tubercle bacilli and MOTT bacilli (Atypical mycobacterium) and Hansen's bacilli

2.6.4 Anaerobic bacilli: Actinomyces spp., Propionibacterium spp, Clostridium spp, Bactertiodes spp.,

2.6.5 Aerobic Gram Negative Bacilli: Enterobacteriaceae

2.6.6 Non Fermentative bacilli and cocco-bacili Pseudomonas spp., Acinetobacter spp., Moraxella spp.

2.6.7 Facultative Anaerobic Bacilli and aerobic cocco-bacilli: Brucella spp., Bordetella spp., Haemophilus spp., Pasteurella spp.

2.6.8 Vibrionaceae Family: Vibrio spp., Campylobacter spp

2.6.9 Aerobic Facultative Spore Forming Bacilli: Bacillus spp.

2.6.10 Spirochetes: Treponema, Borrelia, Leptospira

2.6.11 Gardnerella spp., Listeria spp., Legionella spp., Chlamydia spp., Mycoplasma and Ureaplasma spp., Rickettsia spp.

2.7 **Terminology, mechanism of infection, etiology, laboratory diagnosis, conventional and rapid diagnostic methods for:** Enteric fever, Infective endocarditis, Bacteraemia, Septicemia, Pyrexia of unknown origin (PUO).Lower RTI, Upper RTI, Urinary Tract Infection, Gingivitis and anaerobic infection of oral cavity.Peptic ulcer caused by Helicobacter pylori. Corneal ulcer, Conjunctivitis, Mandibular abscess, Otitis media, External ear infection, Gas gangrene, Bone infection Mycobacterium tuberculosis, Leprosy, Atypical mycobacterium infection. Venereal Diseases: Bacterial vaginosis, Pelvic inflammatory disease, Gonorrhea, Syphilis, Chlamydia, and other sexually transmitted infections; GI Tract:Food poisoning, traveler's diarrhoea, Cholera; Meningitis and Encephalitis(Neisseria, Streptococcus, Haemophilus, Mycobacterium).

Section C - 30% Marks

3. **Mycology:**

3.1 **Classification and characteristic of major groups of fungi**.Morphology and structure of mould and yeast. Definition: Mycology, Medical Mycology, Mycetes, Mycosis, Thallus, Hypha, Mycelium, Coenocyte, Rhizoids.

3.1.1 **Classification, Structure and Physiology of fungi:** Eumycetes (True fungi), Ascomycetes (Histoplasma, Candida, Blastomycosis), Basidiomycetes (Cryptococcus, Rhizopus), Phycomycetes Mucor, Epidermophyton, Fungi imperfecti: (Trichophyton).

3.1.2 **Vegetative Structure (Morphology) of Fungi**: Septate, aseptate, Plectenchyma, Prosenchyma, Pseudoparenchyma,Modification of

Plectenchyma (Rhizomorph, Sclerotia, Stroma).

3.2 **Pathogenic Group of Fungi**Opportunistic pathogens,True pathogens, Blastomyces dermatitidis, Cooccidioides immitis, Paracocidioides brasiliensis, Histoplasma capsulatum, Dermatophytes, Aspergillus spp.; Dermatomycosis (Candida albicans, Cryptococcus neoformans).

3.2.1 **Classification, general characteristics and pathogenesis of medically important fungi:** Zygomycetes, Deuteromycetes, Dematiaceous and Hyaline (*Rhizopus, Mucor, Aspergillus* and *Penicillium; Microsporum, Trichophyton, Epidermophyton),*Dimorphic molds (*Blastomyces, Histoplasma, Coccidioides, Paracoccidioides)* Yeasts (*Candida, Cryptococcus, Rhodotorula*)

3.2.2 **Lab diagnosis of Medically important Fungal Diseases**: Mycoses, Superficial mycoses, Subcutaneous mycoses, Cutaneous mycoses: Dermatophytosis, Systemic mycoses: Blastomycosis, Cryptococcosis, Coccidioidosis, Paracoccidioidosis. Pathogenesis and Laboratory Diagnosis of Mycotic Infections: Aspergillus spp, Candida albicans, Fusarium spp, Cryptococcus neoformans, Histoplasma capsulatum, Blastomyces dermastitidis, Coccidiodis immitis, Sporothorix spp, Phialophora spp.

3.2.2.1 **Isolation and Identification of Fungi (Laboratory Diagnosis):**

- Selection, collection and transportation of specimen: Pus, Blood, Biopsy, Sputum, Urine, Vaginal and Cervical swab, Plueral and peritonial fluid, samples from Mucous membranes, Ear, Eye, Cornial ulcer; Superficial, sub-cutaneous and cutaneous samples.
- Microscopy: KOH Preparation, 20% KOH with 20% Glycerol, KOH – DMSO (Dimethyl Sulphoxide) 100%, Lactophenol Cotton Blue, India ink preparation.
- Isolation of Fungi from different samples; media preparation- Sabourauds Dextrose Agar (SDA), Demonstration of fungi in tissue. Macroscopic Morphology of Fungi, Microscopic (Structure examination on slide culture) Germ tube test, Nutrition deficiency culture method Identification, Antifungal Sensitivity Test; Serological Test: Identification of Antigen, Antibody and Metabolites in Body fluid and Serum.

4. **Virology:**

4.1 **General Properties of Viruses**

4.1.1 Nature, shape, structure and chemical composition of viruses.

4.1.2 Classification of Medically Important Viruses: Genetic material, Organ system involved

4.1.3 Replication of Viruses

4.1.4 Virus Host Interaction

4.1.5 Bacteriophage

4.1.6 Anti viral drugs

4.2 **Epidemiology, Pathogenesis, Treatment, Prevention and Control of Viral Diseases**

4.2.1 DNA Viruses: Adenoviridae, Poxviridae, Herpesviridae, Papoviridae,

Parvoviridae, Hepadnaviridae

4.2.2 RNA Viruses: Orthomyxoviridae, Paramyxoviridae, Picornaviridae, Coronaviridae, Togaviridae, Rhabdoviridae, Retroviridae, Bunyaviridae, Arenaviridae, Filoviridae, Reoviridae and Caliciviridae

4.3 **Laboratory Diagnosis of Viral Infections:**

4.3.1 Sampling in Diagnostic Virology: Selection, collection, storage, transportation and processing of samples

4.3.2 Electron Microscope: Principle, importance and use

4.3.3 Virus isolation. Inoculation in laboratory animals. Egg inoculation. Tissue culture. Recognition of viral growth. Cytopathic effect, Haemadsorption (Hd), Immunofluorescence or immunoperoxidase staining. Interference.

4.3.4 Identification of virus, Neutralization. Haemagglutination – inhibition (HAI).

4.3.5 Histological demonstration of inclusion bodies

4.3.6 Serological tests: Detection of viral antigen, Detection of anti viral antibodies. Complement fixation (CF), Haemagglutination inhibition (HAI), Neutralization (N), Immuno-fluorescence (IFA), Enzyme immunoassay (EIA) or ELISA, Radioimmunoassay (RIA), Single radial immunodiffusion (SRI).

5. **Parasitology:**

5.1 Definition and classification of host and parasites (protozoa, helminthes - intestinal, blood and tissue parasites). Host parasite relationship.

5.1.1 **Habitat, epidemiology, pathogenesis, treatment, prevention, control and laboratory diagnosis (**Selection, Collection, Perseveration and Transportation of Samples; Laboratory Diagnosis: conventional and rapid diagnostic methods (Direct method, Indirect method, Rapid methods, Molecular Technique) Parasite Culture, stains used in parasitology) of:

5.1.1.1 Intestinal Protozoa: Entamoeba histolytica, Giardia lamblia, Trichomonas spp, Cyrptosporidium, Cyclospora, Cystoisospora

5.1.1.2 Intestinal Helminthes: Nematodes -Ascaries lumbricoides, Hook worm, Enterobius vermicularis, Trichuris trichuira, Strongyloides spp ; Cestodes: Tapeworms (Taenia, Hymenolepis), Trematodes: Paragonimus westermani, Liver fluke

5.1.1.3 Blood and Tissue Parasites:Plasmodium spp, Leishmania spp, Wuchereria spp, Brugia malayi, Loa loa,Oncocerca spp, Dracunculus medinensis, Echinococcus spp.

6. **Entomology: Medical Importance and Control of**

6.1 **Mosquitoes:** (Culex, Anopheles, Aedes)

6.2 **Flies** (black flies/Simuliidae, Phlebotomine sandflies/Phlebotominae, Tsetse flies/ Glossinidae) Flies and myasis- sarcophagidae, Oestridae, other myasis-producing flies

6.3 **Fleas** (Siphonaptera)

6.4 **Lice** (Anoplura)- Body louse, head louse, pubic louse

6.5 **Soft ticks** (Argasidae), Hard ticks (Ixodidae)

6.6 **Scabies mites** (sarcoptidae), Scrub typhus mites (Trombiculidae)

Section D - 20% Marks

7. **Public Health Microbiology**:

Concept of health and disease, Indicators of health

7.1 **Air borne diseases**:

7.1.1 Transmission of pathogens, Sources of infection, characters of organisms and controls of: Bacterial pneumonia, Diphtheria, Tuberculosis, Influenza, Measles

7.1.2 Isolation and Identification of microorganisms from air

7.2 **Water Borne Infections:**

7.2.1 Water borne diseases (Viral, bacterial, protozoal), Sources of infection, characters of organisms and control of: Hepatitis, cholera, Typhoid, Amoebiasis , Giardiasis, Poliomyelitis

7.2.2 Isolation and Identification of microorganisms from water and evaluation of water quality.

7.3 **Food Borne Diseases**: Food poisoning (Microbial), Food borne diseases: Transmission of pathogens from food, (virus, bacteria, molds, yeasts), Types of food borne diseases, Causal organism's characters, mode of infection and control, Techniques used in the diagnosis of food borne infections.

7.4 **Insect Transmitted Diseases**: Vector and its types, Mechanisms of transmission of the diseases, Vector transmitted diseases, Transmission, character, and control of: Kala-azar, Malaria, Arboviral diseases (JE, Dengue, etc.), Plague, Techniques used in the diagnosis of vector borne infections

7.5 **Sexual Transmitted Infections**: Various sexual transmitted infections. Characters of causal organisms and control of: Syphilis, HIV/AIDS, Herpes, Hepatitis B and C, Gonorrhea, Control of other sexual transmitted infections, Technique used for the diagnosis of sexually transmitted infection.

7.6 **Hospital-Acquired Infection**: Prophylactic immunization, Disposal of infective hospital and laboratory materials, Technique used for the diagnosis of hospital acquired infection.

8. **Molecular biology**

8.1 Cell and Tissue Culture: Preparation of various reagents, Media and Buffers, Cell and tissue culture techniques

8.2 Gene Transfer: Introduction, Principle, and Application

8.3 Basic concept on restriction fragment length polymorphism (RFLP),Random amplification of polymorphic DNA (RAPD), DNA isolation and purification

8.4 Polymerase Chain reaction: Basic concept of PCR, Conventional and Real time PCR

8.5 Methods of separation and extraction of cell materials (antigens/ antibodies etc).

9. **Immunology**:

9.1 Development and Functions of Immune System: Anatomy of immune system,

9.2 Antigens and Immunogenicity

9.3 Cells Involved in Immune System, Phagocytes, Natural killer cells, Mast cells and basophils, Dendritic cells, Lymphocytes; Lymphoid tissue,

9.4 Origin & maturation of immune cells, T-cells, B-cells,
9.5 Cytokines and chemokines, types and mechanism of action
9.6 Innate Immunity
9.7 Acquired Immunity, T-Cell Mediated Immune Response, B-Cell Mediated (Humoral) Immune Response, Antibodies (Immunoglobulins): Structure, Classes, Types: Allotype, Isotype, Idiotype, Development: Polyclonal and Monoclonal
9.8 Complement System: Classical and Alternative pathways
9.9 Antigen-antibody reactions: Agglutination, Precipitation, Flocculation, ELISA, IHA, RIA, Western blot
9.10 Primary & Secondary Immune Responses
9.11 Hypersensitivity Reactions: Type I to Type V
9.12 Immune Tolerance & Auto immunity: Rheumatoid arthritis and its diagnosis, Collagen diseases , Other auto-immune disease and their diagnosis
9.13 Immunodeficiency Diseases & diagnosis, HIV/AIDS – ELISA, ICT, Western Blot, CD4 cell count; Transplantation
9.14 Basic Concepts on Vaccines and Immunization: Types of vaccines, Immunization Schedules of common vaccines
9.15 Laboratory Animals in immuno-diagnostics: Animal inoculation for diagnosis of various microbial infections and Production of antibodies.

10. **Laboratory Organization and Management**:
10.1 Role & responsibilities of different personals in Laboratory (TOR),SOP, SSP,GLP, Quality control of microbial laboratory, Laboratory safety,
10.2 Laboratory Quality Assessment, Internal quality control and External quality control, Maintaining Reference Bacteria and their Culture

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