OFFICE OF THE PRINCIPAL
GOVERNMENT MEDICAL COLLEGE BARAMULLA

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Subject: Syllabus for written examination for various posts.

Notice

Government Medical College Baramulla has advertised various posts vide Advertisement No.05 of 2023 dated: 16-03-2023.Accordingly, the syllabus for the posts, advertised vide aforementioned advertisement notice is hereby notified as per the details given in Annexure **"A" to "D"** to this notice.

24.04.23

I/C Controller of Examinations
Govt. Medical College
Baramulla

No.GMC/BLA/Exam/2023/06-10 **Dated:** 24**-04-2023**

Copy for information to the:

1. Administrative Secretary to Govt. Health and Medical Education department, Civil Secretariat Jammu.
2. Principal Govt. Medical College Baramulla.
3. Chief Accounts Officer GMC Baramulla/Head of Department Microbiology GMC Baramulla
4. In charge Website to upload this notice on official website of GMC Baramulla.
5. Office copy.

Annexure "A"

Syllabus for Scientist-B (Medical)

General Microbiology

1. Origin and evolution of microorganisms. Distinguishing of different groups of microorganisms, Classification of microorganisms.
2. Cultivation of microorganisms: Types of media- natural and synthetic; autotrophic, heterotrophic and phototrophic media; basal, defined, complex, enrichment, selective, differential, maintenance and transport media.
3. Isolation from different natural samples. Approaches for obtaining pure cultures. Cultivation of aerobes and anaerobes.
4. Enumeration / measurement of growth of microorganisms, Maintenance and preservation of microbial cultures: Repeated sub-culturing, sterile soil/sand preservation, glycerol-deep freezing, oil overlay, drying methods, freeze-drying.
5. Microscopy: a) Simple, b) Compound, c) Phase contrast, d) Fluorescence, e) Confocal, d)Electron

Biosafety

1. Overview of microorganisms and types of viruses, bacteria, prions, etc. [Differences, Vegetative versus spore forms. Cell Tropism and Species Specificity, Infectivity/Pathogenicity/Virulence, Routes of entry/exit, Modes of transmission, Secondary spread, and Immune status of staff and immunization issues.
2. Biosafety Levels and Risk group, Classification, Containment, Good microbiological practices, Disinfection, Decontamination and Sterilization, Agents used, Solid versus liquid waste.
3. Infection prevention and control practices, standard, contact, respiratory, etc.
4. Biomedical waste management and disposal
5. Antimicrobial stewardship Programme (AMSP)
6. Healthcare associated infections, Prevention and Control

General Immunology

1. Introduction and history; Cells and organs of the immune system.
2. Innate immune response & inflammation complement system.
3. Hapten/antigen; antibody, structure & function, Immunoglobulin classes. Antigen & antibody interactions.
4. Hypersensitivity reactions.

Vaccines

1. Conventional vaccines -killed and attenuated.
2. Modern vaccines—recombinant proteins, subunits, DNA vaccines, peptides, immunomodulators (cytokines).
3. Vaccine delivery and vaccination strategies, vaccine components- adjuvants, preservatives, large scale manufacturing-QA/QC issues.
4. Animal models and vaccine potency testing.
5. Clinical trial of vaccines.

Epidemiology of infectious diseases

1. Historical aspects and evolution of epidemiology, definitions and concepts inEpidemiology.

2. Descriptive and analytical epidemiology, disease burden, natural history ofdiseases and measures of risk and death.
3. Sample size estimation and introduction to study design in epidemiologicalinvestigations.
4. Epidemiological triad of disease causation, agent/host/environmental factors
5. Control, elimination, eradication of infectious diseases

eneral Virology

1. History and principles of virology, virus taxonomy, introduction to replicationstrategies.
2. Virus structure and morphology.
3. Viruses of veterinary importance and zoonotic viruses.
4. Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virological laboratory.
5. Bacteriophages, bacteriophage propagation and viroids.
6. Oncolytic viruses

Virological Methods

1. In vivo, in vitro and in ovo systems for virus growth, estimation of yields, methods for purification of viruses with special emphasis on ultracentrifugation methods.
2. Introduction to PCR, ELISA, Agarose Gel electrophoresis, SDS-PAGE, 2-Dimensional Gel Electrophoresis, Southern Blotting, Western Blotting, Northern Blotting
3. Immunodiagnosis, Immunofluorescence assay, haemagglutination and haemagglutination-inhibition tests, Complement fixation, neutralization, Radioimmunoprecipitation assay and immunohistochemistry.
4. Fluorescence, confocal - principles and applications.
5. Detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

Viral infectious diseases

1. Collection and transport of microbiological specimen.
2. General characteristics, pathogenesis, clinical manifestations, prevention and treatment of: HIV/AIDS, Dengue, Viral hemorrhagic fever (VHF) Arboviral VHF (Dengue, Chikungunya, KFD and others) Filoviral VHF (Ebola and Marburg virus), Hantaviral VHF.
3. General characteristics, pathogenesis, clinical manifestations, prevention and treatment of: Viral gastroenteritis (Rotaviruses), Viruses Causing Hepatitis: Hepatitis viruses, yellow fever.
4. General characteristics, pathogenesis, clinical manifestations, prevention and treatment of: Viral Exanthems and Other Cutaneous Viral Infections Herpesviruses (herpes simplex, varicella-zoster and HHV 6 and 7 infection), poxviruses (smallpox, molluscum contagiosum), parvovirus, measles, rubella, coxsackieviruses.
5. General characteristics, pathogenesis, clinical manifestations, prevention and treatment of: Myxovirus Infections of respiratory tract: Influenza, parainfluenza, mumps, respiratory syncytial virus and others, Coronavirus infections including COVID-19.
6. General characteristics, pathogenesis, clinical manifestations, prevention and treatment of: Viral Encephalitis and Encephalopathy Rabies, HSV encephalitis, Arboviral encephalitis (Japanese encephalitis and West Nile), Nipah and Hendra, slow virus and prion disease.
7. Organisms with Oncogenic Potential Human papilloma virus, Kaposi sarcoma, HTLV and HIV, epstein-barr virus, hepatitis B and C.
8. Zoonotic viral infections

Annexure "B"

Syllabus for Lab Technician

ANATOMY

✓ Introduction

- Different parts of the human body, common Anatomical terms, Anatomical Positions and important planes.
- Animal Cell
- Tissue of the body, classification and function
- Primary tissues of the body.

✓ Skeletal System

- Joints & Movements
- Muscle & Monce

✓ Gastro-intestinal System

- Mouth and Pharynx
- Salivary Glands and Tonsils
- Oesophagus and Stomach
- Location of different organs in the Abdomen in situ
- Liver and Gall Bladder
- Spleen and Pancreas.

✓ Genito-Urinary System

- Kidney
- Ureters, Bladder and Urethra
- Male Reproductive System
- Female Reproductive System

✓ Respiratory System

- Thoracic, Pleura and Lungs

✓ Cardio Vascular System

- Heart and Pericardium
- Arterial System
- Venous and Lymphatic System

✓ Nervous System

- Meaning and cerebrospinal fluid
- Brain, Spinal cord and the Nerves.

✓ Loco-Motor System

- **Parts of upper Limb** :- Bones Land marks and important vessels

⊥ PHYSIOLOGY

✓ Theory

✓ Blood

- Composition and General function of Blood
- **Description of Blood cells** :- Normal Counts and function.
- Anti-congulants

✓ Cardio-Vascular System

- Function of heart and blood vessels.
- Circulation :- Systemic Circulation Pulmonary Circulation.

✓ Respiratory System

- Name of the Structure involved in respiration and their function.
- External and Internal respiration. How respiration and expiration are brought about.
- Transport of O^2 and CO^2 in the blood.
- Definition of respiratory Rate, Tidal Volume, Vital Capacity, Cyanosis, Hypoxia.

✓ Excretory System

- Functions of Kidney
- Formation & Composition of Urine Normal and abnormal constituents.

✓ Skin

- Functions of skin

✓ Digestive System

- Composition and functions of saliva, Mastication and deglutition.
- Functions of Stomach, Composition of Gastric Juice Pancreatic Juice, Bile and Succus entericus.

✓ Endocrine Glands

- Definition, name and the hormones secreted by them.
- Major action of each hormone.

✓ Reproductive System

- Male Genital System
- Female Genital System
- Names of Primary and Accessory Sex organs in male and Female. Secondary Sexual characters in male and Female.
- Functions of ovary, formation of Ova, actions of ovarian hormones.
- Functions of Testis – Spermatogenesis and actions of testosterone.

✓ Blood Group

- ABO and Rh. Basis for classification, basis for determination, importance and Blood Groups.

✓ Cerebrospinal Fluid

- Formation, composition and functions.

NIC'↓ BIO-CHEMISTRY

- Elementary knowledge of Inorganic Chemistry Atomic Weight Molecular weight, Equivalent weight –Acids, basis and Salts Indicators Molar Solutions, Buffer Solution, Titration (Acid Base) Definition of Solution. Methods of expressing concentration – Dilution.
- Elementary knowledge of organic Chemistry – organic Compounds. Aliphatic and Aromatic. Alcohols, Aldehydes, ketones, Amines, Esters, Phenol, Acids Colloids etc.
- Elementary of Analytical Chemistry I Instrumentation, centrifuge Balances, Colorimeter, Spetrophtometer, Flamephotometer, Flurimeter etc.
- Aims and Scope Biochemistry.
- Carbohydrates :- Importance, Definition, Classification some properties.
- Proteins – Aminoacids, essential amino acids, peptides, denaturation of proteins, Physiologically important proteins, functions of plasma proteins.
- Lipid – Definition, Classification, Steroids, Examples.
- Nucleic Acids- DNA and RNA their importance.
- Haemoglobin
- Enzymes and Co-Enzymes Elementary.
- Gastric Juice collection Acidites.
- Carbohydrate – Metabolism – elementary aspects, definition of Glucolysis, Glycogenolysis Hormonal regulation of Blood Sugar Diabetes-Mellitus – Ketosis, Gcosuria, Renal Glycosuria, Pentosuria.
- Metabolism of Lipids – elementary aspects, Triglyeerides, Cholestrol, Plasma Lipoproteins- Ketone bodies and Ketonuria.
- Protein Metabolism – Formation of Urea, Creatinine Proteinuria Edema, Transaminases
- Water and Mineral Metabolism – Dehydration, Calcium Phosphorus, Sodium, Potassium, Chloride, Iron, Iodine their physiological functions and disease state.
- Harmones – definition, functions of some important hormones.
- Blood and cerebrospinal Fluid functions of Blood & CSF.
- Urine Normal and abnormal tests.

MICROBIOLOGY AND PARASITOLOGY

↓ *Requirement and use of Common Laboratory Equipment.*

- Incubator, Hot Air Oven, Autoclave, Water bath, Anacrobic jar Vaccum Pump, Media Pouring Chamber, refrigerator, Centrifuge

↓ *Microscope.*

- Principal, Operation, Care and Use of Microscope

↓ *Sterilization and Disinfection.*

- Classification and Genaral principles of Sterilization. Physical Chemical and Mechanical Methods Disposal of contaminated media, Syringes, Glossware, Apparatus.

↓ *Classification and Morphology of Bacteria.*

- **Brief Outline of :-**
  - Structure of cell, capsule, Flagella and spores
  - Growth Bacteria
  - Nutrition of Bacteria.
- ***Staining of Bacteria :***
  - Simple, Grams, Ziehl-Neelsen, Albert, Spore Stain
  - Composition and preparation of Staining reagents

- ***Cultivation of Micro Organisms – I (In Detail)***
  - Classification of Media, Composition of Laboratory culture meida and Special Media
- ***Cultivation of Micro Organisation – II (In Detail)***
- **Identification of Bacteria :**
  - Cultural Characters, Bio Chemical reactions and serotyping.
  - Normal Flora of micro Organisms in the human Body.
  - Gam positive and Gram Negative co....Staphylo.....Penumococcus Neisseria (in brief)

- ***Gram negative Bacilli :***
  - Salmonella, Shigella, E.Coli, Klebsiella, Protein, Pseudomonas Vibro cholera Haemophilus (In brief)
- ***Gram Positive Bacilli***
  - **Aerobic**
    - Corynebacterium diphtheria
    - Mycobacterium tubercoulosis and Mycobacterium leprae.
  - ***Anacrobic bacilli – Clostridia***
- **Antibiotic Sensitivity test** – Principles and methods of determination of sensitivity.
  - Candida, Asperigillus. Dermatophytes
- ***HIV & AID***

- Brief Account
  - Immunity, Antigens, Antibodies and Antigen antibody reaction and their applications in diagnosis of diseases.
  - Principles, Procedures and Diagnostic significance of agglutination Precipitation. Neutralization and complement fixation reactions.
  - Collection and processing of Clinical materials like Sputum. Urine Swabs, Stool, Blood CSF and Aspirates.

✓ **Parasitology :**

Brief Account of :- Morphology, Life Cycle, Pathogenicity and Laboratory Diagnosisof :-

E. Hystolytica, E, Coli Giardia. Trichomonas. Plasmodia Leishmania, Hook worn Round worn, Whip worm. Tape worm, Echinococcus granulosus, granulosus, Dracunculus, Wucheraria Bancrofti.

CLINICAL PATHOLOGY AND HAEMATOLOGY

- Introduction of Haematology
- Collection of Blood
- Antieoagulants
- Red Cell Count :
    - Haemocytometer
    - Methods
    - Caloculation.
- White Cell Count. (Total Leucocyte Count:
    - Morphology of White Cells.
    - Normal Values.
    - Romanowsky Stains
    - Staining Procedures.
    - Counting Methods
- Absolute Eosi Nophil Count :
- Erytrocyte Sedimentation Rate (ESR)
    - Westergren's Method
    - Wintrobe's Method
    - Factors effecting ESR
    - Importance and Limitations
    - Normal Values.
- Packed Cell Volume.
    - Macro and Micro Methods
    - Normal Values.
- Haemoglobin Estimation and its clinical Importance
    - Red Cell indices.
- Calculations and importance.
- Retienlocyte Count :
    - Methods
    - Appearance
    - Normal Values.
- Sickle Cell Preparation.
- Osmotic Fragility Test
    - Scorning Test.
    - Qualitative and Quantitative Test
    - Normal Values.
    - Factors allocating fragility
    - Interpretation
- Peripheral Blood Film
- Preparation of Bone Marrow Smears
- Coagulation Tests.
    - Urimanalysis
    - CSF Examination
    - Semen Analysis
- Coomb's Test.Process of Coagulation
- Factors of Coagulation
- Tests of Coagulation
    - Bleeding time
    - Whole Blood Coagulation Time
    - Clot Retraction Test
    - Toorniquet Test
    - Platelet Count

- Normal Constituent.
- Physical Examination

Chemical Examination
Microscopic Examination

Normal and abnormal Cell Count

- Physical Preterition
- Motility
- Morphology

✓ **Histotechnology:**

- Introduction
- Cell, Tissues and their functions
- Examination Methods of Tissues and Cells
- Fixation of Tissue :
- Classification of fixatives :
    - Simple fixatives and their properties.
    - Micro anatomical fixatives.
    - Cytolofical fixatives.
- Tissue Processing
    - Collection of specimen
    - Labeling and Fixation
    - Dehydration
    - Cleaning
    - Impregnation
    - Section Cutting
    - Staining
- Decalificatation
    - Exfoliative Cytolgy

Microtomes and their Knives
Techniques of Section cutting
Mounting of Sections
Frozen Section

es and their properties

- heory of Staining
- Staining Techniques with haemotoxlin and cosin
- Mounting of Sections
- Common Special Stains

- Fixation
- Decalification
- Detection of end point
- Neutralization and processing

- Types of specimen and preservation
- Preparation and fixation of smears.
- Papanicolaou Staining Techniques
- Sex Chromatin Staining
    - Museum Technique.
        - Reception of specimen
        - Preparation of fixation
        - Restoration of colour
        - Presevation
        - Presentation

- Autopsy Technique
- Assisting in Autopssy
- Preservation of organs & Processing of Tissue.

Laboratory Management and Ethics

- Role of the Laboratory in the Health Care Delivery System :
  - General
  - Human Health & Diseases.
    - Types of Diseases
    - Process of Diagnosis
    - Laboratory at different levels
    - Duties and responsibilities of Laboratory Personnel

- Laboratory Service in the Health Care Delivery System in India :
  - Laboratory Service in India
  - The Health Administration System in India
    - At the National Level\
    - At the State Level
    - At the District Level
    - At the Village Level
    - Voluntary Health Organisation in India

- Laboratory Planning :
  - General Principals
  - Laboratory Goals
  - Operational Data
    - Market Potential
    - Hospital / Laboratory relatives
    - Competitions
    - Laboratory Trends
    - Planning at different levels
    - Guiding Principles for planning Hospital laboratory Services :
      - Factors
      - Guiding Principles for Planning
      - Functional Criteria
      - Operational Demnad
      - Sections of a Hospital Laboratory
      - Common Area
      - Design Aspect
      - Space requirement.

Planning for a basic health Laboratory.

- Laboratory organization (Laboratory Management Techniques) :
  - General Principles
  - Components and Functions of a laboratory
  - Staffing the Laboratory
  - Job descriptions
  - Job specification
  - Work Schedule

- Personnel re-arrangement and work load assessment.

- Care of Laboratory Glassware, Equipments and Instruments and Chemicals etc :
    - General Principles
    - Care and Cleaning of Glassware
    - Making simple glass wares in Laboratory
    - Care of equipments, Instruments and apparatus etc
    - Laboratory Chemicals their proper use and care
    - Labelling.

- Specimen Handling :
    - General Principles
    - Collection Techniques and containers for specimen
    - Types of specimens
    - Specimens entry
    - Specimens transfer and distribution and re-assignment
    - Specimens disposal
    - Specimens preservation.

- Laboratory Safety :
    - General Principles
    - Laboratory Hazards.
    - Safety Programmes
    - First Aid

Annexure "C"

Syllabus for Scientist-B (Non-Medical)

General Microbiology

1. Origin and evolution of microorganisms. Distinguishing of different groups of microorganisms, Classification of microorganisms.
2. Cultivation of microorganisms: Types of media- natural and synthetic; autotrophic, heterotrophic and phototrophic media; basal, defined, complex, enrichment, selective, differential, maintenance and transport media.
3. Isolation from different natural samples. Approaches for obtaining pure cultures. Cultivation of aerobes and anaerobes.
4. Enumeration / measurement of growth of microorganisms, Maintenance and preservation of microbial cultures: Repeated sub-culturing, sterile soil/sand preservation, glycerol-deep freezing, oil overlay, drying methods, freeze-drying.
5. Microscopy: a) Simple, b) Compound, c) Phase contrast, d) Fluorescence, e) Confocal, d)Electron

Biosafety

1. Overview of microorganisms and types of viruses, bacteria, prions, etc. [Differences, Vegetative versus spore forms. Cell Tropism and Species Specificity, Infectivity/Pathogenicity/Virulence, Routes of entry/exit, Modes of transmission, Secondary spread, and Immune status of staff and immunization issues.
2. Biosafety Levels and Risk group, Classification, Containment, Good microbiological practices, Disinfection, Decontamination and Sterilization, Agents used, Solid versus liquid waste.
3. Infection prevention and control practices, standard, contact, respiratory, etc.
4. Biomedical waste management and disposal
5. Antimicrobial stewardship Programme (AMSP)
6. Healthcare associated infections, Prevention and Control

General Immunology

1. Introduction and history; Cells and organs of the immune system.
2. Innate immune response & inflammation complement system.
3. Hapten/antigen; antibody, structure & function, Immunoglobulin classes. Antigen & antibody interactions.
4. Hypersensitivity reactions.

Vaccines

1. Conventional vaccines -killed and attenuated.
2. Modern vaccines—recombinant proteins, subunits, DNA vaccines, peptides, immunomodulators (cytokines).
3. Vaccine delivery and vaccination strategies, vaccine components- adjuvants, preservatives, large scale manufacturing-QA/QC issues.
4. Animal models and vaccine potency testing.
5. Clinical trial of vaccines.

Epidemiology of infectious diseases

1. Historical aspects and evolution of epidemiology, definitions and concepts in Epidemiology.
2. Descriptive and analytical epidemiology, disease burden, natural history ofdiseases and measures of risk and death.
3. Sample size estimation and introduction to study design in epidemiological investigations.
4. Epidemiological triad of disease causation, agent/host/environmental factors
5. Control, elimination, eradication of infectious diseases

General Virology

1. History and principles of virology, virus taxonomy, introduction to replication strategies.
2. Virus structure and morphology.
3. Viruses of veterinary importance and zoonotic viruses.
4. Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virological laboratory.
5. Bacteriophages, bacteriophage propagation and viroids.
6. Oncolytic viruses

Virological Methods

1. In vivo, in vitro and in ovo systems for virus growth, estimation of yields, methods for purification of viruses with special emphasis on ultracentrifugation methods.
2. Introduction to PCR, ELISA, Agarose Gel electrophoresis, SDS-PAGE, 2-Dimensional Gel Electrophoresis, Southern Blotting, Western Blotting, Northern Blotting
3. Immunodiagnosis, Immunofluorescence assay, haemagglutination and haemagglutination-inhibition tests, Complement fixation, neutralization, Radioimmunoprecipitation assay and immunohistochemistry.
4. Fluorescence, confocal - principles and applications.
5. Detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

Molecular Biology

1. Genomes: types, diversity in size, structure and organization in viruses, prokaryotes (nucleoid) and eukaryotes (chromosomes, ploidy, chromatin andnucleosomes). Central dogma theory and flow of genetic information.
2. Genes: The modern concept of the genes, gene structure and architecture, types of genes.
3. Plasmids: detection, types, properties, purification, transfer, replication and curing, significance / importance.
4. Mobile genetic elements: Prokaryotes - types and structure of bacterial transposons, and molecular mechanism of transposition.
5. Gene transfer mechanisms and gene mapping in bacteria: Natural and artificial transformation. Conjugation and sexduction. Transductions (generalized; abortive, specialized and co-transduction).
6. Genetic recombination: Requirements for recombination. Molecular models / basis of recombination.
7. Replication / perpetuation of nucleic acids: Concepts, definitions, and strategies / models for replication. Molecular mechanisms of DNA replication in prokaryotes and eukaryotes. Replication of single stranded DNA. Inhibitors of DNA replication.
8. DNA damage and repair: Classes / types of damage. Repair mechanisms – mismatch repair, short patch repair, nucleotide / base excision repair, recombination repair and SOS system.
9. Mutations: Types, causes and consequences of mutations. Mutagens and their mode of action. Isolation and analysis of bacterial / phage mutants. Importance of mutants in genetic analysis, point mutation.
10. Transcription (RNA biosynthesis): Types of RNA and their role. Organization of protein and RNA encoding transcription units and their transcription in prokaryotes and eukaryotes. Types of RNA polymerases. Inhibitors of transcription.
11. Translation (protein biosynthesis): Genetic code and its elucidation, structure and composition of prokaryotic and eukaryotic ribosomes, structural features of rRNA, mRNA and tRNAs in relation to function, steps of protein biosynthesis (activation of amino acids, initiation, elongation, termination) in prokaryotes and eukaryotes; post-translational modification of proteins and their sorting and targeting; regulation of translation; inhibitors of protein biosynthesis; in vitro translation systems.
12. Regulation of gene expression: An overview on levels of regulation, terminology and operon concepts, enzyme induction and repression; positive and negative regulation in *E. coli*- lac, regulation by attenuation - trp operons; Eukaryotic GeneRegulation.
13. Gene silencing mechanisms: Transcriptional and post-transcriptional silencing. RNA silencing, CRISPR/Cas9 technology and gene regulation.

Recombinant DNA Technology

1. Scope and importance of recombinant DNA technology.
2. Tools for Recombinant DNA Technology: Gene vectors-Plasmid, transposon, bacterophage, Enzymes–different nucleases, DNA and RNA polymerases, DNA joining enzymes (ligases, topoisomerase, recombinase) and other nucleic acid modifying enzymes. Source DNA - genomic DNA, cDNA.
3. Cutting and joining of DNA molecules-generation and joining of blunt and sticky ended DNA molecules using linkers, adaptors and homopolymer tails and PCR amplicons, TdT.
4. Techniques for gene manipulation: DNA sequencing -Chemical, dideoxy chain termination, primer walking, automated sequencing, pyrosequencing, next generation sequencing methods.
5. Molecular diagnostics: Nucleic acid blotting and hybridization - Preparation of DNA and RNA probes, PCR- principles, Primer designing, factors affecting PCR, different types of PCR and Real time PCR, RT-PCR and their applications and limitations. DNA profiling - RFLP, AFLP, RAPD and DNA finger printing and their applications.
6. Site directed mutagenesis and protein engineering: Different approaches forchanging genes.
7. Gene cloning strategies: Construction of genomic DNA and cDNA libraries and different strategies for selection, screening and analysis of recombinants. Recombinogenic engineering, Green Fluorescence protein, Fusion proteins— signals for protein secretion, purification of recombinant proteins.
8. Gene cloning & Expression in bacteria, yeast, plant and animal cells-construction of cell specific recombinant vectors, introduction of them into targeted cells by different approaches and screening and isolation of recombinant cell clones.
9. Functional genomics - transcriptome and gene expression profiling. In vitro mutagenesis and deletion techniques, genes knock out in bacterial and eukaryotic organisms.

Bioinformatics

1. Introduction and biological data bases: Nucleic acid, proteins, genomes, structure data bases, search engines, sequence data formats and submission tools, scoring matrices for sequence alignments, algorithms—pairwise sequence alignments, database similarity searches—BLAST, FASTA.
2. Methods for sequence analysis: Multiple sequence alignment, phylogenetic analysis and tree building methods, data mining tools and applications secondary/ derived databases, motif & family searches, epitope prediction, etc.
3. Structure based approaches: Protein secondary structure prediction, threading approaches, homology based methods for protein tertiary structure prediction, visualization tools, structure evaluation and validation.
4. Primer designing for PCR.

Annexure "D"

Syllabus for Research Assistant

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4. Biomedical waste management and disposal
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3. Hapten/antigen; antibody, structure & function, Immunoglobulin classes. Antigen & antibody interactions.
4. Hypersensitivity reactions.

Vaccines

1. Conventional vaccines -killed and attenuated.
2. Modern vaccines—recombinant proteins, subunits, DNA vaccines, RNA vaccines, peptides,immunomodulators (cytokines).
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4. Fluorescence, confocal - principles and applications.

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1. Genomes: types, diversity in size, structure and organization in viruses, prokaryotes

(nucleoid) and eukaryotes (chromosomes, ploidy, chromatin andnucleosomes). Central dogma theory and flow of genetic information.

2. Plasmids: detection, types, properties, purification, transfer, replication and curing, significance / importance.
3. Mobile genetic elements: Prokaryotes - types and structure of bacterial transposons, and molecular mechanism of transposition.
4. Gene transfer mechanisms and gene mapping in bacteria: Natural and artificial transformation. Conjugation and sexduction. Transductions (generalized; abortive, specialized and co-transduction).
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6. Transcription (RNA biosynthesis): Types of RNA and their role. Organization of protein and RNA encoding transcription units and their transcription in prokaryotes and eukaryotes. Types of RNA polymerases. Inhibitors of transcription.
7. Translation (protein biosynthesis): Genetic code and its elucidation, structure and composition of prokaryotic and eukaryotic ribosomes, structural features of rRNA, mRNA and tRNAs in relation to function, steps of protein biosynthesis (activation of amino acids, initiation, elongation, termination) in prokaryotes and eukaryotes;post-translational modification of proteins, inhibitors of protein biosynthesis.

Recombinant DNA Technology

1. Scope and importance of recombinant DNA technology.
2. Tools for Recombinant DNA Technology: Gene vectors-Plasmid, transposon, bacterophage, Enzymes–different nucleases, DNA and RNA polymerases, DNA joining enzymes (ligases, topoisomerase, recombinase) and other nucleic acid modifying enzymes. Source DNA - genomic DNA, cDNA.
3. Cutting and joining of DNA molecules-generation and joining of blunt and sticky ended DNA molecules using linkers, adaptors and homopolymer tails and PCR amplicons, TdT.
4. Techniques for gene manipulation: DNA sequencing -Chemical, dideoxy chain termination, primer walking, automated sequencing, pyrosequencing, next generation sequencing methods.
5. Molecular diagnostics: Nucleic acid blotting and hybridization - Preparation of DNA and RNA probes, PCR- principles, Primer designing, factors affecting PCR, different types of PCR and Real time PCR, RT-PCR and their applications and limitations. DNA profiling - RFLP, AFLP, RAPD and DNA finger printing and their applications.

Bioinformatics

1. Introduction and biological data bases: Nucleic acid, proteins, genomes, structure data bases, search engines, sequence data formats and submission tools, scoring matrices for sequence alignments, algorithms—pairwise sequence alignments, database similarity

searches—BLAST, FASTA.

2. Methods for sequence analysis: Multiple sequence alignment, phylogenetic analysis and tree building methods, data mining tools and applications secondary/ derived databases, motif & family searches, epitope prediction, etc.
3. Primer designing for PCR.