Colour Coding
Global GREEN
Regional BLUE
National ORANGE
Local (State) PINK

Sanjay Gandhi postgraduate Institute of Medical Sciences (SGPGIMS), Lucknow, India

Department of Microbiology

Curriculum for MSc MLT in Medical Virology

Admissions to the M.Sc. MLT (Medical Laboratory Technology) Medical Virology) courses: Currently there is provision of 6 seats every year. Admission will be made through common entrance examination conducted by the Institute and comprising of MCQs on an All-India entrance examination basis. The seats will be advertised every year on Institute's website www.sgpgi.ac.in.

Essential Qualifications: A pass in B.Sc. (Medical Laboratory Technology) or B.Sc. (Microbiology) or any equivalent degree from a recognized University securing minimum of 50% marks in aggregate with laboratory experience. Further 5% relaxation is permitted to reserved category candidate having domicile of Uttar Pradesh. Candidates passing B.Sc. through correspondence course shall not be eligible. Applicant should be able to communicate well verbally in English.

Duration: 2 years course followed by 6 months Internship. (Stipend during internship subject to approval of UP Govt).

Course Coordinators: Dr. Atul Garg will be responsible for preparing class schedules and day to day activities related to course under guidance of Dr. Rungmei S K Marak, Professor and Head, Department of Microbiology.

Leave Entitlement: The students will be normally entitled for following leaves (subject to pandemic conditions and change in teaching roster)

1. **Winter Break:** 07 days in December
2. **Summer Break:** 21 days in June

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Needs: Local : Pink, National : Orange, Regional: light blue, International : green

3. **Other leaves:** Subject to achieving 80% attendance in theory classes and practical individually

which is essential to be allowed to appear in the annual examination. Deficiency in attendance, if any, to be made up in the vacations.

Purpose of Course and benefit to student:

The course is designed with aim to train young enthusiastic minds into future scientist. We plan to teach basics of microbiology, Medical virology and its clinical implications; so that our pass out student can work both in Academic/Clinical Research.

Course Benefit to Indian Health System:

The pass out students will be well versed in routine virology techniques like ELISA, viral culture, RT-PCR, sequencing data analysis etc. They can work as scientist and supervise virology laboratory in case of COVID-19 like Pandemic. During the course the students will be mentored to do research and can pursue a Post-Doc fellowship etc. and become a good researcher.

The course will consist of four semesters, followed by 6-month internship.

Semester 1:

Paper 1: Basic Microbiology

Paper 2: Basic virology

Semester 2:

Paper 3: Cellular structure and Immunology

Paper 4: Virology Techniques

Semester 3:

Paper 5: Epidemiology, Biostatistics & Entomology

Paper 6: Clinical virology

Semester 4:

Paper 7: Recent advances in medical Virology

Paper 8: Desertions and research work (Thesis submission)

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Theory

Paper 1: Topics for Basic Microbiology

1. History and Introduction to microbiology
2. Biosafety and biosecurity
3. Taxonomy and nomenclature
4. Morphology and classification of bacteria
5. Microbes and man source of infection and congenital infections
6. Staining techniques
7. Culture media and biochemicals
8. Sterilization and disinfection
9. Microscopy principles and applications
10. Introduction to mycology, cultivation and important human disease
11. Introduction to Parasitology, cultivation and important human disease
12. Introduction to Antimicrobial chemotherapy
13. Molecular diagnosis of infectious disease
14. Biomedical waste management

Paper 2: Topics for Basic Virology

1. History and Morphology of virus.
2. Biosafety cabinets and BSL labs
3. Taxonomy and classification of virus
4. Bacteriophage
5. Pathogenesis and replication of virus.

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6. Pox virus and Adeno virus
7. Papova virus
8. Herpes virus
9. Parvo virus.
10. Picorna virus
11. Orthomyxovirus
12. Paramyxovirus
13. Retrovirus
14. Rhabdo virus
15. Arbo virus
16. Prions and slow virus
17. SARS CoV
18. Zika, Nipah, Tomato flu, Hand foot and mouth disease and emerging virus

Paper 3: Immunology and cellular structures

A. Immunology

1. **Introduction to Immunology**
   Introduction and history of immunology, primary and secondary organs of immune system, cells of the immune systems.

2. **Innate Immunity**
   Innate immune response, complement systems

3. **Antigen**
   Structure, types, haptens, super antigens.

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4. **Immunoglobulins**

Antibody structure and function, Immunoglobulin classes.

5. **Antigen antibody reactions**

Basics, precipitation and agglutination reaction

6. **Structure and function of immune system**

7. **Hypersensitivity**

8. **Antigen Recognition**

Antibody diversity, major histo-compatibility complex, ontogeny, positive and negative selection.

9. **Acquired immune response**

Antigen presenting cells, T cells stimulation.

10. **Antiviral Immune response and hybridoma technology**

Immune responses in various viral infections, generation of monoclonal antibodies-principles and applications.

11. **Advanced Immunology**

Secondary signalling, co-stimulation, cell signalling in immune response, Deactivation, B cells as APC, Peptide epitopes T cell B cell antigenic properties, prediction of T and B cells epitopes, chimeric peptides, polytype vaccines, major- histo-compatibility complex-1, polymorphism.

12. **Immunological Diseases**

Auto immunity and viral infections, immune deficiency and HLA association with disease.

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8. **Cultivation and purification of viruses:** In vivo, in vitro and in Ovo systems for virus growth, estimation of yields, methods for purification of viruses.
9. **Nucleic acid-based diagnostics:** Nuclei acid extraction and its quality control, Nucleic acid hybridization, polymerase chain reaction, microarray etc.
10. **Sequencing:** Sanger Sequencing and Next generation sequencing.

Paper 5: Epidemiology, Biostatics and Entomology

A. Basic Epidemiology and Statistics

Introduction

Historical aspects and evolution of epidemiology definitions and concept in Epidemiology.

Approaches in Epidemiology

Descriptive and analytical epidemiology, disease burden, natural history of disease and measure of risk and death.

Study design sampling

Sample size estimation and introduction to study design in epidemiological investigations.

Fundamentals in Biostatistics

Introduction, types of data, tabular and graphical presentation of data.

Measures of location, dispersion and correlation

Measures of central tendency: Mean, mode, median, GM, HM, quartiles, Measures of Dispersion-range, standard deviation, variance, coefficient of variation.

Probabilities and Statistical Interference

Concept and probability distribution. Normal distribution-density curves, applications and statical tables. Concept of significance tests, parametric and non-parametric tests, standard error and confidence intervals.

Public Health Surveillance

Types and methods of public health and infectious disease surveillance, establishing surveillance system, outbreak investigations, collaborations with state and national health authorities.

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Analytical Epidemiology

Case control and cohort studies

B. Medical Entomology

Insect morphology, Collection and Preservation

Introduction to general entomology, insect morphology and classifications of insects and other arthropods of medical importance and their structures and functions. Method of collecting these insect and arthropods their preservation, maintenance and transportation.

Biology and ecology of mosquitoes

Biology and life history of Aedes, culex, and Anopheles their behavior and ecology with special reference to dengue, Chikungunya Japanese Encephalitis and West Nile.

Biology and ecology of ticks, flea and mites

Biology, ecology, life history of ticks with special reference to Kyasanur Forest Disease (KFD).
Biology and morphology of mites.
Vectors of Sand fly fever and scrub typhus

Vector virus Relationship

Virus dissemination & mechanism of virus transmission vectors, natural cycle, maintenance of viruses in nature, basis of vector competence, mechanical transmission, virus dissemination, susceptibility-intrinsic and extrinsic factors. Xeno diagnosis- methods and applications.

Vector Borne viral diseases

Formation of natural foci of diseases, spatial structure and geographic variations. Animal movements, host Preference of vectors and their influence, natural cycle and Population biology of vector borne pathogen, GIS in vector borne viral diseases.

Vector Control

Various control strategies and environmental management. Control in urban settings. Control at aquatic stages, adult population, personal protection and insecticide resistance mechanism and control dynamics.

Molecular Entomology

Molecular characterization of vectors.

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Paper 6: Topics for Medical Virology

1. **Viral Enteric Diseases:** Clinical course, disease burden, risk factors, epidemiology, prevention, and treatment. Rotavirus. Other viruses associated with diarrhea and gastroenteritis: Adenoviruses, astroviruses, Norwalk and Sapporo-like viruses and Enteroviruses.
2. **Oncogenic virus:** Etiology, Role of papilloma, HIV, Epstein Barr Virus, HTLV and herpes in pathogenesis ofcancers, diagnosis, prevention.
3. **Viral Hepatitis:** Etiology, clinical presentation, epidemiology of viral hepatitis, Structure & genotypes, serotypes of HAV, HBV, HCV & HEV. Mutations in hepatitis viruses. Serological and molecular diagnosis of different hepatitis viruses. Prevention & therapeutic approaches
4. **Viral Respiratory Diseases**: Etiology and lab diagnosis of viral respiratory diseases, clinical features, epidemiology of influenza, RSV and other respiratory diseases.
5. SARS CoV: Biology, pathogenesis, lab diagnosis of of SARS CoV-2, Metapneumovirus, human rhino virus and other Corona virusetc.
6. **Vaccines against different viral respiratory infections**.
7. **Viral Exanthematous Diseases**: Biology, pathogenesis, lab diagnosis of Pox, mumps, rubella, measles, Herpes, VZV, Parvo B -19
8. **Viral Hemorrhagic Fevers:** Dengue and other Arbo virus, Ebola, Marburg etc.
9. **Viral Encephalitis: Encephalitis:** Encephalopathy and meningitis clinical symptoms and causative agents, treatment modalities, Transmission, spread of the outbreak in relation to causative agent Laboratory diagnosis of viral encephalitic agents, basic principles, preferred methods and problems. (JE, West Nile, herpes, Nipah, Rhabdo virus, Chandipura etc.)
10. **HIV/ AIDS**
11. **Transplant associated viral infections**

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Paper 7: Recent advances in Molecular Virology

Bioinformatics

Introduction and Biological Data bases

Nucleic Acids, proteins, genomes- Structured at a bases, search engines, sequenced at a forms and submission tools, scoring matrices for sequence alignments, algorithms- pairwise sequence alignments, database similarity searches- BLAST, FASTA

Methods for sequence analysis

Multiple sequence alignment, phylogenetic analysis and tree building methods, motif searches, epitope prediction, data mining tools and applications, promoter and gene prediction, comparative analysis.

Advanced Molecular Techniques

1. RFLP
2. Microarrays
3. Crisper Cas

Introduction to Nanotechnology

Overview/Application

Antivirals and Viral Vaccines

Viral Vaccines

Conventional vaccines – killed and attenuated, modern vaccines- recombinant proteins, subunits, DNA vaccines, peptides, immune- modulators (cytokines), vaccine delivery and adjuvants, large scale manufacturing- QA/QC issues.

Anti-Viral

Interferons, designing and screening of anti-viral, mechanism of action, antiviral libraries, anti-retro viral- mechanism of action and drug resistance, anti-HCV and anti- Influenza drugs.

Modern approaches of virus control

Molecular Epidemiology of emerging viral infections

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M.Sc. MLT Medical Virology Practical - First Year

Practical in first semester

1. Glassware Decontamination, Washing Sterilization Packing& Sterile Handling
2. Media & Reagents Preparation and sterility Checks
3. Sample collection & Processing
4. Sterilization and disinfection
5. Staining techniques
6. Culture techniques
7. Automated culture system
8. Laboratory work practices
9. Preparation of Viral media
10. Personal protective equipment
11. Maintenance of bio safety cabinet.
12. Tzank smear
13. Waste segregation and BMW disposal

Practical in second semester

1. Preparation, Maintenance of Cell Cultures & Viral Inoculation
2. Freezing & Revival of Cell Lines
3. Estimation of TCID 50
4. Enteric virus culture
5. POLIO ITD RTPCR
6. ELISA
7. Inverted microscopy
8. Gel Electrophoresis
9. Spectrophotometry
10. Pipette handling and calibration
11. HAI, HA, CFT

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12. IgM capture ELISA Chikungunya
13. IgM capture ELISA Dengue
14. Rubella Diagnosis
15. Measles Diagnosis
16. Neutralization Test

Practical in Third semester

1. Graphical Presentation of Data
2. Presentation of Data : Mean, Deviation ,Std. Error & ANOVA
3. Epidemiological Exercise- Study Design
4. MSEXCEL 2000
5. Statistical Software Exercise-Surveillance
6. Feeding Patters of Mosquitoes & House flies & Mouth parts Dissection
7. Mosquito Collection & Taxonomy
8. Taxonomy of Ticks & sandflies
9. Processing of Arthropods
10. Biochemical Analysis
11. Dusk & Dawn Collection
12. Dissection of Mosquitoes – Salivary Glands & Mid guts
13. Insecticide Bioassays (Larval & Adult)
14. Repellent Evaluation
15. Nucleic Acid Extraction
16. Detection DNA & RNA
17. Estimation of DNA & RNA quality
18. PCR
19. Real Time PCR
20. Qualitative RTPCR: Arbovirus, COVID, swine flu etc
21. Quantitative RTPCR: CMV, BK virus etc.

Practical in Fourth semester

1. Biological Data Banks & Bio-informatics
2. NCBI, IVR, SWISSPROT & GISAID
3. Sequence Alignment Tools
4. Multiple Alignment
5. BLAST
6. Nucleic Acid To Translation
7. Sequence Assemble
8. Phylogeny Analysis
9. Software: Mega & Bio Edit
10. Multiplex RTPCR

The Board of Studies unanimously approved the presented agenda

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