SEMESTER	**1**
Course	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5101
Paper Title	Basics of Microbiology and Infectious Diseases
No. of Credits	4
Theory / Practical / Composite	THEORY
Minimum No. of preparatory hours per week a student has to devote	4hrs/week
Number of Modules	2
Number of weeks per semester	10
Syllabus	**MODULE 1: Basics of Microbiology [20L]** • Biosafety and Bio-Security: Biosafety levels, Difference between Bio-Safety and Bio-Security, Classification of microbial agents basedon hazard groups, Types of biosafety cabinets, Biomedical waste segregation and management, Pollution Control Board, Institutional Biosafety Committee. (TMCK) • Classification of microbes of medical importance: Bacteria: aerobes,anaerobes, Gram positive, Gram negative, intra-cellular bacteria, Mycobacteria,(DD) Viruses: DNA and RNA viruses (KS) Fungi: yeasts and molds. (AKM) Parasites: protozoans and helminths (AKM) (SXC) • **Host-Pathogen interaction (MM,KS)** • Pathogenicity (MM) • Virulence (MM) • Host specificity(MM) • Tissue tropism (MM) • Innate immunity (KS) • Acquired immunity: cell mediated, antibody mediated (KS) • Immune response to infection (KS) **MODULE 2: Fundamentals of Infectious diseases and Infection Prevention & Control (TMCK) [20L]** • Fundamentals of infectious diseases and epidemiology a. Pathogen, commensal b. Infection and colonization c. Colonization versus contamination d. Modes of transmission of infection e. Virulence, pathogenicity f. Infectious dose, lethal dose g. Incubation period

	h. Period of infectivity i. Infectious disease syndromes j. Diagnosis and treatment of infectious diseases k. Prevention of infectious diseases: immuno- l. prophylaxis, chemo-prophylaxis. (TMCK) • • Infection Prevention and Control (IPC) a. Standard precautions b. Transmission based precautions: contact/enteric/droplet/ airborne/isolation precautions c. Laboratory acquired infections d. Hand Hygiene e. Personal Protective Equipment f. Biomedical waste management g. Environmental cleaning and disinfection h. Respiratory hygiene and cough etiquette i. Safe injection practices j. Sterilization and disinfection. (TMCK)
Learning Outcomes *3	1) Biosafety and Biosecurity: To have a thorough knowledge about the Biosafety levels and its application 2) Learning about various medically important microbial pathogens 3) To understand host-pathogen interactions 4) To know about different infectious organisms and their control
Reading/Reference Lists *4	WHO. Laboratory biosafety manual, 3rd edition, 2004. https://www.who.int/publications/i/item/9241546506 WHO. Laboratory Biosafety manual, 4th edition. 2020. https://www.who.int/publications/i/item/9789240011311 WHO. Laboratory Biosecurity Guidance. 2023. https://www.who.int/publications/i/item/9789240095113 Ananthanarayan and Paniker's Textbook of Microbiology, Twelfth Edition. 2022. Paniker's Textbook of Medical Parasitology
Evaluation	Total Marks: 100 CIA: 20 Marks: (Each module: 10 marks) End semester Exam: 80 Marks (Each module: 40 marks)
Paper Structure for Theory Semester Exam	Paper Structure: End semester Exam: 80 Marks Two Modules: 40 marks each Question Pattern: Each Module: MCQ-20 marks (2 marksX10 questions to be attempted out of 12 questions given) (5 marks X 4 Questions to be attempted out of 6questions given)

SEMESTER	**1**
Course	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5102
Paper Title	Applied Laboratory Techniques in Microbiology
No. of Credits	4
Theory / Practical / Composite	Theory
Minimum No. of preparatory hours per week a student has to devote	4hrs/week
Number of weeks per semester	10
Number of Modules	2
Syllabus	**MODULE 1:** Conventional Methods for Diagnosis of Infectious Diseases (TMCK) [20L] Equipment and instruments in a Medical Laboratory: a. Biosafety cabinet b. Laminar Flow hood c. Fume Hood d. Autoclave e. Centrifuge: swing bucket and fixed-angle, non-refrigerated and refrigerated f. pH meter g. Analytical balance h. Hot air oven i. Deep freezer: minus 20°C and minus 80°C j. Incubators: 25°C, 37°C and Carbon dioxide k. Lyophilizer l. Air particle counter m. Membrane filtration system for water microbiology n. Total Dissolved Solids (conductivity) meter o. Chlorine meter p. Light microscope q. Fluorescence Microscope r. Automated Blood culture and mycobacterial culture system s. Automated bacterial and yeast identification and susceptibility testing system t. Serology analyzers based on ELISA, ELFA, CLIA, ELFA methods

	2. MODULE 2: [20L] Molecular Methods for Diagnosis of Infectious Diseases **Equipment in a Molecular Biology Laboratory: (TMCK)** a. Nucleic acid extraction systems: automated b. Bead beater c. System to check quality and quantity of DNA post extraction: d. Nanodrop spectrophotometer e. System to quantify DNA: Qubit fluorometer f. System to detect DNA integrity post extraction (e.g. Tape Station) g. End point PCR system h. Real-time PCR system (qPCR) i. Droplet Digital PCR system (ddPCR) j. Cartridge Based Nucleic acid amplificationsystems k. DNA sequencing system by Sanger method l. Next Generation Sequencing Systems:MiSeq (Illumina), Ion Studio, Oxford Nanopore Technology. **Classification and types of molecular methods for the diagnosis of infectious diseases (TMCK)** • Amplification based molecular methods: • Target amplification: • Polymerase Chain reaction • LCR, SDA, NASBA, LAMP, isothermal amplification • Signal amplification • Hybrid capture assay • Branched DNA assay • Non-amplification based molecularmethods: • FISH • Miscellaneous methods: Line Probe Assay, Gene chips or DNA micro-array **Nucleic acid Extraction** m. DNA extraction (MMG) n. RNA extraction (JG) o. Manual method p. Automated method **Polymerase Chain Reaction and its types (SXC) +(TMC)** q. End point PCR (MMG) r. Real-time PCR (MMG) s. Qualitative PCR (JG) t. Quantitative PCR (JG) u. Nested PCR (MMG) v. Multi-plex PCR (MMG) w. PCR followed by melt- curve analysis (TMCK) x. Droplet Digital PCR (TMCK) y. CBNAAT: Cartridge Based Nucleic Acid Amplification systems (TMCK)
Learning Outcomes *3	1) Understanding the Principles, and applications of General Microbiological Instruments

	2) Studying different molecular methods for the diagnosis of infectious diseases 4) To know the detailed principle for isolation of RNA and DNA
Reading/Reference Lists *4	Chomczynski P and Sacchi N. "The single-step method of RNA isolation by acid guanidinium thiocyanate–phenol–chloroform extraction: twenty-something years on". Nature Protocols 1(2):581-585; 2006. https://microbenotes.com/rna-isolation-protocol Vogel et al. "RNomics in Escherichia coli detects new sRNA species and indicates parallel transcriptional output in bacteria." Nucleic Acids Research, Vol. 31 No. 22, 2003 Mackie & Mccartney Practical Medical Microbiology, 14th edition. 1996. Aysal A, Pehlivanoglu B, Ekmekci S, Gundogdu B. How to Set Up a Molecular Pathology Lab: A Guide for Pathologists. Turk Patoloji Derg. 2020;36(3):179-187. doi: 10.5146/tjpath.2020.01488. PMID: 32525209; PMCID: PMC10510618. Hardy DJ. Practical Aspects and Considerations When Planning a New Clinical Microbiology Laboratory. Clin Lab Med. 2020 Dec;40(4):421-431. doi: 10.1016/j.cll.2020.08.015. Epub 2020 Oct 1. PMID: 33121612; PMCID: PMC7528893. Buchan BW, Ledeboer NA. Emerging technologies for the clinical microbiology laboratory. Clin Microbiol Rev. 2014 Oct;27(4):783-822. doi: 10.1128/CMR.00003-14. PMID: 25278575; PMCID: PMC4187641.
Evaluation	Total Marks: 100 CIA: 20 Marks: (Each module: 10 marks) End semester Exam: 80 Marks (Each module: 40 marks)
Paper Structure for Theory Semester Exam	Paper Structure: End semester Exam: 80 Marks Two Modules: 40 marks Question Pattern: Each Module: MCQ-20 marks (2 marksX10 questions to be attempted out of 12 questions given) (5 marks X 4 Questions to be attempted out of 6 questions given)

SEMESTER	**1**
Course	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5103
Paper Title	Bio-Statistics
No. of Credits	4
Theory / Practical / Composite	Theory
Minimum No. of preparatory hours per week a student has todevote	4hrs/week
Number of weeks per semester	10
Number of Modules	1
Syllabus	**1.** Descriptive Statistics: Population and sample. Classification of data. Collection, tabulation and graphical representation of data. Frequency distributions. Measures of central tendency (Mean, Median and Mode). Regression. Contingency table. Odds ratio and relative risk.(DB) [9L] 2. Probability: Addition and multiplication laws of probability, conditional probability, Bayes Theorem. Random variable. Binomial, Poisson, Gaussian, and exponential distributions. Bivariate Probability distribution, Bivariate Normal: properties. (AC) [9L] 3. Sampling and Inference: Statistic and its sampling distribution. Standard error of the Statistic. Chi-square, t and F distribution. Confidence intervals of mean and variance. Hypothesis testing- Simple and Composite Hypothesis, Null and alternative Hypothesis, Type-1 and Type-2 errors, Level of Significance, Power, Critical Region, p value. Testing of mean variance and association.(DB) [9L] 4. Regression analysis: Logistic regression, confusion matrix and ROC curve. Sensitivity, Specificity, PPV, NPV.(AC) [9L] 5. Use of Statistical Software. (AC+DB) [4L]
Learning Outcomes *3	1) Understanding and Applying Basic Descriptive Statistics. 2) Analyzing Probabilistic Models in Medical Data Contexts. 3) Conducting Inference for Hypotheses Testing. 4) Evaluating Predictive Models Using Regression Techniques.
Reading/Reference Lists *4	Fundamentals of Statistics Vol-I by A.M. Gun, M.K. Gupta, and B. Dasgupta. Hogg, R.V., Tanis, E.A. and Rao J.M. (2009): Probability and Statistical Inference, Seventh Ed, Pearson Education, New Delhi. Ismay, C. and Kim, A.Y., Statistical Inference via Data Science, A Modern Dive into R and the Tidyverse, CRC Press Talor and Francis group, 2020.

	Moulin, P. and Venugopal, V.V., Statistical Inference for Engineers and Data Scientists, Cambridge University Press. Ilstrup DM. Statistical methods in microbiology. Clin Microbiol Rev. 1990 Jul;3(3):219-26. doi: 10.1128/CMR.3.3.219. PMID: 2200604; PMCID: PMC358156. Dakhale GN, Hiware SK, Shinde AT, Mahatme MS. Basic biostatistics for post-graduate students. Indian J Pharmacol. 2012 Jul-Aug;44(4):435-42. doi: 10.4103/0253-7613.99297. PMID: 23087501; PMCID: PMC3469943. Yan F, Robert M, Li Y. Statistical methods and common problems in medical or biomedical science research. Int J Physiol Pathophysiol Pharmacol. 2017 Nov 1;9(5):157-163. PMID: 29209453; PMCID: PMC5698693. GraphPad QuickCalcs: https://www.graphpad.com/quickcalcs/
Evaluation	Total Marks: 100 CIA: 20 Marks End semester Exam: 80 Marks
Paper Structure for Theory Semester Exam	Paper Structure: End semester Exam: 80 Marks Question Pattern: Each Module: MCQ-40 marks (2 marksX20 questions to be attempted out of 24 questions given) (5 marks X 8 Questions to be attempted out of 12 questions given)

SEMESTER	1
Course *1	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5151
Paper Title	Basic Laboratory Techniques
No. of Credits *2	4
Theory / Practical / Composite	Practical Paper
Minimum No. of preparatory hoursper week a student has to devote	6hrs/week(3 classes in SXC+3 classes in TMCK)
Number of weeks per semester	10
Number of Modules	1
Syllabus	**Good Clinical Laboratory Practice: (TMCK) [30L]** o Dos and don'ts within laboratory premises o Biomedical waste segregation o Bio-safety and bio-security o Use of PPE o Environmental cleaning and disinfection o Hand Hygiene o Management of sharps injury and splash exposure with laboratory or clinical areas o Spill management o Fire safety; Chemical safety; Electrical safety o Immunization of laboratory workers **Conventional methods for the diagnosis ofinfectious diseases (TMCK)** o Microscopy o Culture: bacteria, mycobacteria, fungi, virus o Biochemical identification ofbacteria, fungi **Serological methods. (SXC MCBA) KS,MM,SSC,DD [30L]** o Neutralization o Agglutination o Precipitation o Complement Fixation Test o ELISA and its modifications o Radio-Immuno Assay o Immuno-fluorescence test o Immuno-chromatography test o Anti-microbial Susceptibility Testing: Disc diffusion test o E- test o Broth Micro-Dilution test o Automated Systems o Molecular methods for anti-microbial susceptibility testing

Learning Outcomes *3	1) To understand “Good Clinical Laboratory Practice” and its utility 2) To know about Techniques for the identification of potentially pathogenic Organisms 3) To understand the basic Principles of serology testing/analysis 4) To Understand when and how to use the serological methods in diagnosis of certain bacterial, parasitic, Viral, diseases 5) Learning about various types of media used to culture Microorganisms and culture techniques.
Reading/Reference Lists *4	Basic Serological Testing by Rowa Yousef Alhabbab Medical Laboratory Technology, 4/e, Vol 2 Procedure Manual for Routine Diagnostic Tests Including Molecular Pathology by Kanai L Mukherjee Growing Mycobacterium smegmatis mc 2 155, Phage hunting Program (Phage hunting PROTOCOLS). Mackie & Mccartney Practical Medical Microbiology, 14th edition. 1996. The European Committee on Antimicrobial Susceptibility Testing - EUCAST. https://www.eucast.org/ CLSI M100 – 2025. Performance Standards for Antimicrobial Susceptibility Testing, 35th Edition
Evaluation	CIA: 80 MARKS End Semester Viva Voce: 20 Marks
Paper Structure for Theory Semester Exam	CIA: 80 MARKS End Semester Viva Voce: 20 Marks

SEMESTER	**1**
Course *1	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5104 and DMMB5152
Paper Title	RESEARCH METHODOLOGY
No. of Credits *2	4
Theory / Practical / Composite	Critical Appraisal of Research Paper
Minimum No. of preparatory hoursper week a student has to devote	4hrs/week
Number of weeks per semester	10
Number of Modules	1
Syllabus	**Study Designs: (TMCK,SXCMCBA)** 1. Randomized Control Trials 2. Systematic Review and Meta- Analysis 3. Case Control studies 4. Cohort Studies 5. Case Reports and Case Series Critical Appraisal of Research papers: 1. Evidence Based Medicine 2. Hierarchy of evidence 3. Critical appraisal tool kits
Learning Outcomes *3	1. Know various types of study designs used in Medical Sciences and in Clinical Trials 2. Know how to critically appraise a research paper 3. Know presentation methods in Journal Clubs
Reading/Reference Lists *4	Kiani AK, et al Methodology for clinical research. J Prev Med Hyg. 2022 Oct 17;63(2 Suppl 3):E267-E278. doi: 10.15167/2421-4248/jpmh2022.63.2S3.2769. PMID: 36479476; PMCID: PMC9710407. Critical Appraisal Tools. https://www.cebm.ox.ac.uk/resources/ebm-tools/critical-appraisal-tools Evidence Based Medicine (EBM) tools. https://www.cebm.ox.ac.uk/resources/ebm-tools Zlowodzki M, Jönsson A, Kregor PJ, Bhandari M. How to write a grant proposal. Indian J Orthop. 2007 Jan;41(1):23-6. doi: 10.4103/0019-5413.30521. PMID: 21124678; PMCID: PMC2981889.
Evaluation	Presentation: 50 marks Viva voce: 50 marks
Paper Structure for Theory Semester Exam	Write up: 50 marks DMMB5104 Presentation and Viva voce: 50 marks DMMB5152

SEMESTER	**2**
Course *1	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5201
Paper Title	Advanced Molecular Microbiology
No. of Credits *2	4
Theory / Practical / Composite	Theory
Minimum No. of preparatory hours per week a student has to devote	4hrs/week
Number of weeks per semester	10
Number of Modules	2
Syllabus	**MODULE 1: [20L]** **Sequencing Techniques for Disease detection (TMCK)** 1. Sanger Sequencing o 16S rRNA sequencing for bacteria o ITS gene sequencing for fungi o Use of NCBI BLAST o Anti-viral resistance testing: • HIV • HBV • CMV • Influenza 2. Next Generation Sequencing and its applicationin Medical Microbiology o Whole genome sequencing (WGS) • WGS for WHO priority pathogens • SARS CoV-2 • *Mycobacterium tuberculosis* • HIV o Targeted Sequencing • ARG (antibiotic resistance genes) • Pathogen identification o Metagenomic sequencing • Microbiome studies **MODULE 2:** PCR Primer and probes and their design(TMCK+SXC)[20L] 1. PCR Primer and probes and their design o Types of primers o Types of probes o Properties of PCR primers and probes o Primer and probe design software
Learning Outcomes *3	1. To learn different PCR and Sequencing techniques for detection of different clinically important Bacteria, Virus and Fungi 2. Know how to design PCR primers and probes using software
Reading/Reference	Sachse, K., & Frey, J. (Eds.). (2003). *PCR detection of microbial*

Lists *4	*pathogens (Vol. 216)*. Springer Science & Business Media. Brasher, C. W., DePaola, A., Jones, D. D., & Bej, A. K. (1998). Detection of microbial pathogens in shellfish with multiplex PCR. *Current microbiology*, *37*, 101-107. How to: Design PCR primers and check them for specificity. https://www.ncbi.nlm.nih.gov/guide/howto/design-pcr-primers/ Primer BLAST. https://www.ncbi.nlm.nih.gov/tools/primer-blast/ Feeney M, Murphy K, Lopilato J. Designing PCR primers painlessly. J Microbiol Biol Educ. 2014 May 1;15(1):28-9. doi: 10.1128/jmbe.v15i1.634. PMID: 24839513; PMCID: PMC4004736. Pryce TM, Palladino S, Kay ID, Coombs GW. Rapid identification of fungi by sequencing the ITS1 and ITS2 regions using an automated capillary electrophoresis system. Med Mycol. 2003 Oct;41(5):369-81. doi: 10.1080/13693780310001600435. Erratum in: Med Mycol. 2004 Feb;42(1): 93. PMID: 14653513. Deurenberg RH, Bathoorn E, Chlebowicz MA, Couto N, Ferdous M, García-Cobos S, Kooistra-Smid AM, Raangs EC, Rosema S, Veloo AC, Zhou K, Friedrich AW, Rossen JW. Application of next generation sequencing in clinical microbiology and infection prevention. J Biotechnol. 2017 Feb 10;243:16-24. doi: 10.1016/j.jbiotec.2016.12.022. Epub 2016 Dec 29. PMID: 28042011. HIV Drug Resistance database. Stanford University. https://hivdb.stanford.edu/ HBV Seq. Stanford University. https://hivdb.stanford.edu/HBV/HBVseq/development/HBVseq.html
Evaluation	Total Marks: 100 CIA: 20 Marks: (Each module: 10 marks) End semester Exam: 80 Marks (Each module: 40 marks)
Paper Structure for Theory Semester Exam	Paper Structure: End semester Exam: 80 Marks Two Modules: 40 marks each Question Pattern: Each Module: MCQ-20 marks (2 marksX10 questions to be attempted out of 12 questions given) (5 marks X 4 Questions to be attempted out of 6 questions given)

SEMESTER	2
Course *1	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5202
Paper Title	Bioinformatics and Automation in a Molecular Microbiology lab
No. of Credits *2	4
Theory / Practical Composite	Theory
Minimum No. of preparatory hours per week a student has to devote	4hrs/week
Number of weeks per semester	10
Number of Modules	2
Syllabus	**MODULE 1: (SXC) [20L]** **Basics of Bioinformatics(KS,SSC,AB)** o Application of bio-informatics in whole genome sequencing o Application of bio-informatics in microbiome analysis **MODULE 2: (TMCK) [20L]** **Informatics and Automation in a Molecular Microbiology lab** Informatics and Automation in a molecular Microbiology lab o LIS: Laboratory Information System o HIS: Hospital information System o Laboratory Informatics o Data protection, Data security, data storage, Classification of data o Automations in bacteriology, Serology, Virology
Learning Outcomes *3	1. To Learn an Innovative and evolving field of Bioinformatics with a multidisciplinary approach. Students will understand the data analysis in the field of Bioinformatics and their application in the field of Bioinformatics, Biomedical Research 2. To understand application of Bio-informatics in Medical Microbiology 3. To understand principles and application of informatics in Medical Microbiology
Reading/Reference Lists *4	Bioinformatics-a Practical Guide to the analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd 2009 Essential Bioinformatics by Jin xiong., Cambridge University press, New York 2006 Bioinformatics: Sequence and Genome analysis by Mount D; Cold Spring Harbor Lb. Press New York 2004 Introduction to Bioinformatics by Teresa K Attwood, David J Parry Smith Pearson Education 1999

	GLASS whole-genome sequencing for surveillance of antimicrobial resistance. https://www.who.int/publications/i/item/9789240011007 Bayat A. Science, medicine, and the future: Bioinformatics. BMJ. 2002 Apr 27;324(7344):1018-22. doi: 10.1136/bmj.324.7344.1018. PMID: 11976246; PMCID: PMC1122955. Bansal AK. Bioinformatics in microbial biotechnology--a mini review. Microb Cell Fact. 2005 Jun 28;4:19. doi: 10.1186/1475-2859-4-19. PMID: 15985162; PMCID: PMC1182391. Rhoads DD, Sintchenko V, Rauch CA, Pantanowitz L. Clinical microbiology informatics. Clin Microbiol Rev. 2014 Oct;27(4):1025-47. doi: 10.1128/CMR.00049-14. PMID: 25278581; PMCID: PMC4187636. Greub G, et al A; ESGMD Study Group. Clinical bioinformatics for microbial genomics and metagenomics: an ESCMID Postgraduate Technical Workshop. Microbes Infect. 2020 Nov-Dec;22(10):626-634. doi: 10.1016/j.micinf.2020.07.008. Epub 2020 Aug 22. PMID: 32841729.
Evaluation	Total Marks: 100 CIA: 20 Marks: (Each module: 10 marks) End semester Exam: 80 Marks (Each module: 40 marks)
Paper Structure for Theory Semester Exam	Paper Structure: End semester Exam: 80 Marks Two Modules: 40 marks each Question Pattern: Each Module: MCQ-20 marks (2 marksX10 questions to be attempted out of 12 questions given) (5 marks X 4 Questions to be attempted out of 6 questions given)

SEMESTER	2
Course *1	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5203
Paper Title	Oncogenic Microbes andQMS
No. of Credits *2	4
Theory/ Practical/ Composite	Theory
Minimum No. of preparatory hours per week a student has to devote	4hrs/week
Number of weeks per semester	10
Number of Modules	2
Syllabus	**MODULE 1**: **Oncogenic Microbes (TMCK+SXC) [20L]** 1.Study of cancer related Microbes (AKM) Oncogenic viruses and other microbes causing human cancers o Helicobacter pylori o Human Papilloma Virus o Hepatitis B Virus o Hepatitis C Virus o Epstein Barr Virus o Human Herpes Virus 8 o HTLV- 1, HTLV- 2 o Clonorchis sinensis o Schistosoma haematobium **MODULE 2: Quality Management Systems(TMCK) [20L]** o DQ, IQ, OQ, PQ (Design qualification, installation qualification, operational qualification, performance qualification) o Validation and verification of a diagnostic test o Internal Control o Proficiency Testing (PT) o External Quality Assurance (EQA) o Inter Laboratory Comparisons (ILC) o NABL accreditation o Equipment calibration and maintenance o Inventory management o Staff competency assessment o Standard Operating Procedure
Learning Outcomes *3	1) To Know about different microbes associated with development of Cancer and their mechanism 2) To learn different Quality management systems
Reading/Reference Lists *4	Viruses and Human Cancer: From Basic Science to Clinical Prevention, Editors: Mei Hwei Chang, Kuan-The Jeang. Springer Viruses: The Invisible enemy (2nd edn), Dorothy H Crawford, Oxford, Oxford academic Ding SZ, Goldberg JB, Hatakeyama M. Helicobacter pylori infection,

	oncogenic pathways and epigenetic mechanisms in gastric carcinogenesis. Future Oncol. 2010 May;6(5):851-62. doi: 10.2217/fon.10.37. PMID: 20465395; PMCID: PMC2882595. Tornesello ML, Buonaguro FM. Human Papillomavirus and Cancers. Cancers (Basel). 2020 Dec 15;12(12):3772. doi: 10.3390/cancers12123772. PMID: 33333750; PMCID: PMC7765250. Chang MS, Kim WH. Epstein-Barr virus in human malignancy: a special reference to Epstein-Barr virus associated gastric carcinoma. Cancer Res Treat. 2005 Oct;37(5):257-67. doi: 10.4143/crt.2005.37.5.257. Epub 2005 Oct 31. PMID: 19956524; PMCID: PMC2785932. El-Serag HB. Epidemiology of viral hepatitis and hepatocellular carcinoma. Gastroenterology. 2012 May;142(6):1264-1273.e1. doi: 10.1053/j.gastro.2011.12.061. PMID: 22537432; PMCID: PMC3338949. Efared B, Bako ABA, Idrissa B, Alhousseini D, Boureima HS, Sodé HC, Nouhou H. Urinary bladder Schistosoma haematobium-related squamous cell carcinoma: a report of two fatal cases and literature review. Trop Dis Travel Med Vaccines. 2022 Feb 15;8(1):3. doi: 10.1186/s40794-022-00161-x. PMID: 35164874; PMCID: PMC8845255. Machicado C, Marcos LA. Carcinogenesis associated with parasites other than Schistosoma, Opisthorchis and Clonorchis: A systematic review. Int J Cancer. 2016 Jun 15;138(12):2915-21. doi: 10.1002/ijc.30028. Epub 2016 Feb 19. PMID: 26840624. Fedak KM, Bernal A, Capshaw ZA, Gross S. Applying the Bradford Hill criteria in the 21st century: how data integration has changed causal inference in molecular epidemiology. Emerg Themes Epidemiol. 2015 Sep 30;12:14. doi: 10.1186/s12982-015-0037-4. PMID: 26425136; PMCID: PMC4589117. Rubinstein PG, Aboulafia DM, Zloza A. Malignancies in HIV/AIDS: from epidemiology to therapeutic challenges. AIDS. 2014 Feb 20;28(4):453-65. doi: 10.1097/QAD.0000000000000071. PMID: 24401642; PMCID: PMC4501859. NTERNATIONAL STANDARD ISO 15189 Fourth edition 2022-12 Medical laboratories — Requirements for quality and competence. https://www.iacld.com/UpFiles/Documents/2e096ce5-485b-4f22-b7be-e557fb7d06f8.pdf
Evaluation	Total Marks: 100 CIA: 20 Marks: (Each module: 10 marks) End semester Exam: 80 Marks (Each module: 40 marks)
Paper Structure for	Paper Structure: End semester Exam: 80 Marks

Theory Semester Exam	Two Modules: 40 marks each Question Pattern: Each Module: MCQ-20 marks (2 marksX10 questions to be attempted out of 12 questions given) (5 marks X 4 Questions to be attempted out of 6 questions given)

SEMESTER	**2**
Course *1	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5251
Paper Title	Analytical and Research Methods in Medical Microbiology
No. of Credits *2	4
Theory / Practical / Composite	PRACTICAL
Minimum No. of preparatory hours per week a student have to devote	6hrs/week(3 classes in SXC+3 classes in TMCK)
Number of weeks per semester	10
Number of Modules	2
Syllabus	**MODULE 1: Clinical Biochemistry and Enzymology (TMCK+SXC) [30L]** o Importance of cancer biomarkers (enzymes and metabolites- like Apolipoprotein 1)- Activity Based Proteomics (SXC) o Tumour markers: Alpha Feto-Protein (AFP),CA-15-3; CA- 125, CA- 19-9, CEA (carcino embryonic antigen), HCG (human chorionic gonadotropin), prostate specific antigen, etc. (TMCK) o Study and assay of prostatic acid phosphatase from serum (PAP) kit-based assay Study of serum Prostate Specific antigen (PSA) (SXC). o Study and assay of serum alkaline phosphatase o Basic knowledge of enzyme (kinetics and assay) and market enzymes in cancer diagnosis and therapy o Assay and importance of Monoamine oxidase A (MAO-A) enzyme is involved in Reactive oxygen species regulation (SXC) o Therapeutic Drug Level Monitoring (TDM) using mass spectroscopy **MODULE 2**: **Research Methodology(TMCK) [30L]** o Research questions and hypothesis o Study design o Sample size estimation o Research ethics o Research logistics o Data management o Writing of research grants
Learning Outcomes *3	1) To study the cancer related Biomarkers 2) To study the basic enzyme kinetics related to diagnosis of cancer and therapy 3) To study the enzyme related to Oxidative stress 4) To learn quick and efficient methods for the diagnosis of factors involved in cancers and other diseases 5) Understand how to write for research grants

	6) Understand principles of GCP (Good Clinical Practice) training
Reading/Reference Lists *4	Clinical Biochemistry: Nanda Maheshwari 3rdEdition JAYPEE Clinical Biochemistry: Murphy, Srivastava Clinical Biochemistry by Dr Satarupa Thakurta Clinical Biochemistry, second edition, by Gaw et al, Published by Churchill and Livingstone. Good Clinical Practice. National Drug Abuse Treatment Clinical Trials Network https://gcp.nidatraining.com/
Evaluation	CIA: 80 MARKS 1) End Semester Viva Voce: 20 Marks
Paper Structure for Theory Semester Exam	CIA: 80 MARKS End Semester Viva Voce: 20 Marks

SEMESTER	2
Course *1	MOLECULAR MEDICAL MICROBIOLOGY (PGD MMM)
Paper Code	DMMB5252
Paper Title	Project Work
No. of Credits *2	4
Theory/ Practical/ Composite	Project Work
Minimum No. of preparatory hours per week a student has to devote	4hrs/week
Number of weeks per semester	10
Number of Modules	1
Syllabus	Project related to Medical Microbiology and Molecular Biology [40L]
Learning Outcomes *3	3) Understand design and implementation of project work 4) Carry out project work in a time bound manner 5) Write reports on project work 6) Make presentations on project work 7) Know how to publish project work in scientific journals
Reading/Reference Lists *4	Microbiology in the 21st Century: Where Are We and Where Are We Going? This report is based on a colloquium sponsored by the American Academy of Microbiology held September 5–7, 2003, in Charleston, South Carolina. Washington (DC): American Society for Microbiology; 2004. Available from: https://www.ncbi.nlm.nih.gov/books/NBK560448/ doi: 10.1128/AAMCol.5Sept.2003 Jhaveri TA, Weiss ZF, Winkler ML, Pyden AD, Basu SS, Pecora ND. A decade of clinical microbiology: top 10 advances in 10 years: what every infection preventionist and antimicrobial steward should know. Antimicrob Steward Health Epidemiol. 2024 Jan 25;4(1):e8. doi: 10.1017/ash.2024.10. PMID: 38415089; PMCID: PMC10897726. Kanza S, Knight NJ. Behind every great research project is great data management. BMC Res Notes. 2022 Jan 21;15(1):20. doi: 10.1186/s13104-022-05908-5. PMID: 35063017; PMCID: PMC8781028. Levin SP, Levin M. Managing Ideas, People, and Projects: Organizational Tools and Strategies for Researchers. iScience. 2019 Oct 25;20:278-291. doi: 10.1016/j.isci.2019.09.017. Epub 2019 Sep 17. PMID: 31605943; PMCID: PMC6817648.
Evaluation	Total Marks: 100 Project work: 50 Marks Presentation and Viva Voce: 50 Marks
Paper Structure for Theory Semester Exam	Total Marks: 100 Project work: 50 Marks Presentation and Viva Voce: 50 Marks