

Course Details – CMPD Course

Program Name: - Certificate in Molecular Pathology & Diagnostics

1	Name of the Program	Certificate In Molecular Pathology & Diagnostics
2	Program Code	CMPD
3	Program Pattern (Semester/Final)	Final
4	Program Duration	3 Months
5	Program Level	Certificate
6	Program Type	Full Time for regular students (Offline) & Distance for In service candidates (Online) (with 3 Personal contact program each 5 days)
7	Program Total Credits	Nil
8	Program Total Marks	600
9	Program Passing Marks	270 (45% As per Table B)
10	Mode of Learning (Regular/ Distance Learning)	Regular / Distance for In service candidates/Students
11	Medium of Instructions	English
12	Medium of Examination	English
13	Eligibility	The students with following educational qualification will be eligible for seeking admission to this course : MBBS, DCP (Diploma In Clinical Pathology) BAMS, MD (Ayu - Rognidan), BSc, MSc (Biochemistry), BSc, MSc (Microbiology), or Virology or Mycology BSc, MSc (Biotechnology), BSc, MSc (Pathology), or Histology or Immunology BSc, MSc (Genetics), or Parasitology BSc, MSc (Molecular biology) or Cell biology, DMLT, PGDMLT, BSc-MLT, BPMT
14	Lecturer/Professor Qualification	The teaching faculties with following educational qualification will be eligible to teach this course : MBBS, MD (Clinical Microbiology) BSc, MSc (Microbiology) MSc (Biotechnology)
15	Program Objectives	The Course aims to provide the advanced hands-on training related to molecular pathology laboratory Diagnostic procedures and techniques involved in it.
16	Program Outcome	Student will be up-skilled for each & every molecular pathology related procedure and advanced diagnostic technology
17	No. of Days @ Week	3 Days
18	Internship Duration	15 Days
19	Study Center	Vishakha micro labs, 6 th Floor, Lokmat Bhavan, Ramdaspath, Nagpur – 440 012
20	Course Fee	Rs. 15,000/- (Fifteen Thousand only)

Syllabus & Course Content with Hourly Teaching Plan

Certificate in Molecular Pathology & Diagnostics		
Sr. No.	SUBJECT CODE	SUBJECT TITLE
1	CMPD – 101	Molecular Biology & Genomics
2	CMPD – 102	Nucleic acid and Protein based diagnostics
3	CMPD – 103	Cytogenetics & Immunodiagnostics

Sub Code	Subjects	Teaching hours per week (3 Days @ Week)	Tutorial (*T)/ Practical / Activity(*P/*A) per week		Theory		Practical		Subject Total		No. of Credits
			T	P/A	Max	Passing	(Practical/ Diss. / Viva/ Oral/ Test/ Sessional etc.)		(in case of joint passing)		
							A		B		
			Max	Passing	Max	Passing	Max	Passing			
CMPD 101	Molecular Biology & Genomics	3	1	2	100	45	100	45	200	90	2
CMPD 102	Nucleic acid and Protein based diagnostics	3	1	2	100	45	100	45	200	90	2
CMPD 103	Cytogenetics & Immunodiagnostic	3	1	2	100	45	100	45	200	90	2
Total		09	03	06	300	135	300	135	600	270	6

Question Paper Pattern

EXAMINATION- Theory

PROGRAME NAME- Certificate in Microbiology Diagnostic Techniques

SUBJECT TITLE_____ (Course Code-_____)

[TIME: 3 Hours] TOTAL: 100 Marks

Note- 1. Attempt Section A and Section B Only

2. Write answers to each question in proportion to the mark allotted
3. Available both **online** as well as **offline** mode

SECTION – A

Que-1 Explain: Attempt Any one out of 2 questions (20 Marks each)

Que-2 Explain: Attempt Any Two out of 3 questions (15 Marks each)

SECTION – B

Que-1 Explain: Attempt Any one out of 2 questions (20 Marks each)

Que-2 Explain: Attempt Any Two out of 3 questions (15 Marks each)

PRACTICAL

Practical - 1 (40 Marks)

Practical - 2 (40 Marks)

Viva Voce (20 Marks)

Hourly Teaching Plan For CMPD Course

Paper – 1

Molecular Biology & Genomics

(Theory – 100 Marks + Practical Viva – 100 Marks)

Module No.	Sub Topics	Hours
Module No. 1 (Theory)	Introduction to Molecular Diagnostics	1 hr
	Human Genetics and Genomics	1 hr
	Principles of inheritance - Mendelian and Non-Mendelian inheritance,	1 hr
	Polygenic inheritance, Multifactorial trait, Threshold trait,	1 hr
	Genetic Susceptibility & risk factors	1 hr
	Mitochondrial genome and disorders.	1 hr
	Medical Genetics: Human genome Project, Genome Organization, Genome Annotations and Databases	1 hr
	Identifying human disease genes. Genetic markers for diseases.(microsatellites, SNPs),	1 hr
	Pharmacogenomics, Ecogenomics, Metabolomics, Teratogenetics	1 hr
	Mapping and identification of disease genes (linkage analysis, LOD score, association study) SNPs in diagnostics	1 hr
	Disease identification and Genetic tests for following disorders - Thalassemia, Fanconi anemia, Sickle Cell anemia,	1 hr
	Disease identification and Genetic tests for following disorders - Fragile-X syndrome, Alzheimer's disease, Huntington's disease	1 hr
	Disease identification and Genetic tests for following disorders - Duchenne Muscular Dystrophy/ Becker's Muscular Dystrophy,	1 hr
	Molecular Diagnosis of human genetic disorders Beta thalassemia Down's Syndrome Retinitis pigmentosa	1 hr
	Checking of p53 gene polymorphism for susceptibility to cancer	1 hr
	Human identification and paternity determination (simulated) by VNTR Probes	1 hr
	Mutation detection methods	1 hr
Functional protein identification- 2D gels	1 hr	

	Forensic Application – Paternity Testing, victim Identification, crime detection,	1 hr	
	Neonatal and Prenatal disease diagnostics - Gender identification using amelogenin gene locus.	1 hr	
	Amplification of Y chromosome specific Short Tandem Repeats (Y-STR).	1 hr	
	Analysis of mitochondrial DNA for maternal inheritance.	1 hr	
	Molecular diagnosis for early detection of cerebral palsy, Down syndrome etc.	1 hr	
	Molecular Techniques for diagnosis - PCR- RFLP,	1 hr	
	Molecular Techniques for diagnosis ARMS-PCR, ELISA,	1 hr	
	Molecular Techniques for diagnosis Multiplex-PCR, SSCP,	1 hr	
	Molecular Techniques for diagnosis - CSGE, DGGE,	1 hr	
	Molecular Techniques for diagnosis DHPLC	1 hr	
	Molecular Techniques for diagnosis MALDI-TOF	1 hr	
	Molecular Techniques for diagnosis - DNA Sequencing	1 hr	
A	Hours And Credit	30 hrs	2
Module 1 (Practical)	PCR- RFLP	1 hr	
	ARMS-PCR	1 hr	
	ELISA	1 hr	
	Multiplex-PCR	1 hr	
	SSCP	1 hr	
	CSGE	1 hr	
	DGGE	1 hr	
	DHPLC	1 hr	
	MALDI-TOF	1 hr	
	DNA Sequencing	1 hr	
B	Hours And Credit	10 hrs	0.5
A + B	Total Hours And Credit	40 hrs	2.5

Paper – 2

Nucleic acid and Protein based diagnostics
(Theory – 100 Marks + Practical Viva – 100 Marks)

Module No.	Sub Topics	Hours	Credit
Module No. 1 (Theory)	Isolation and Purification of Nucleic acids - Principles and Methods	1 hr	
	Molecular cloning	1 hr	
	labelling of nucleic acids	1 hr	
	hybridization.	1 hr	
	Nucleic acid amplification methods and types of PCR: Reverse Transcriptase-PCR, Real-Time PCR,	1 hr	
	Inverse PCR, Multiplex PCR, Nested PCR, Alu-PCR,	1 hr	
	Hot-start <i>In situ</i> PCR, Long-PCR, PCR-ELISA, Arbitrarily primed PCR,	1 hr	
	Ligase Chain Reaction.	1 hr	
	Proteins and Amino acids , Qualitative and quantitative techniques: Protein stability, denaturation;	1 hr	
	Amino acid sequence analysis	1 hr	
	Hybridization techniques – Southern, Northern, in-situ (including FISH), microarrays – types and applications;	1 hr	
	Protein extraction and analysis (including PAGE and its variations)	1 hr	
	Western Blot	1 hr	
	Applications of PCR- PCR based microbial typing: Amplified Ribosomal DNA Restriction analysis (ARDRA) in Bacterial Pathogen	1 hr	
	Molecular diagnosis of fungal pathogens based on 18SrRNA sequences	1 hr	
	Detection of viral pathogens through PCR.	1 hr	
	Molecular diagnosis of parasitic disease	1 hr	
	PCR in forensic science - AmpFLP, STR, Multiplex PCR- Determination of Paternity- Human identification and sex determination.	1 hr	
	Automated DNA sequencing- Principles, Methods and Instrumentation-	1 hr	
Advances in DNA sequencing- New Generation sequencing Methods, Pyrosequencing	1 hr		

	Proteomics- Clinical Proteomics.	1 hr	
A	Total Hours And Credit	22 hrs	1
Module No. 2 (Practical)	Isolation of Genomic DNA from microbe (<i>E.coli</i>), and Human (<i>Peripheral Blood</i>).	1 hr	
	Plasmid DNA isolation by Alkaline lysis and Boiling method.	1 hr	
	Quality / Quantity checking of Nucleic acids by a) UV Spectrophotometer and b) Agarose Gel Electrophoresis.	1 hr	
	Molecular Cloning- ligation	1 hr	
	Competent cell preparation	1 hr	
	Transformation- selection of recombinants (Blue white selection)	1 hr	
	Confirmation of recombinants by gel electrophoresis.	1 hr	
	Nucleic acid labeling and Southern Hybridization	1 hr	
	Automated DNA sequencing (Demo).	1 hr	
	RNA isolation (from rat liver) and Pulsed Field Gel Electrophoresis	1 hr	
	PAGE - Denaturing gradient gels, Temperature gradient gels	1 hr	
	Western Blot	1 hr	
	Culture independent analysis of microbes by DGGE (Denatured Gradient Gel Electrophoresis)	1 hr	
	and T-RFLP (Terminal Restriction Fragment Length Polymorphism).	1 hr	
	Detection of transgenes in GMOs	1 hr	
	PCR amplification using primers that amplify the regions consisting of dinucleotide repeats,	1 hr	
	Amplification of Short Tandem Repeats (STR)/Microsatellites.	1 hr	
	Multiplex STR PCR (Demo).	1 hr	
	Single strand conformation polymorphism (SSCP) analysis.	1 hr	
	HLA typing and tissue transplantation matching (Demo)	1 hr	
Microarrays for pathogen detection and SNP studies (Demo).	1 hr		
B	Total Hours And Credit	20 hrs	0.5
A + B	Total Hours And Credit	42 hrs	1.5

Paper – 3
Cytogenetics & Immunodiagnostics
(Theory – 100 Marks + Practical Viva – 100 Marks)

Module No.	Sub Topics	Hours	Credit
Module No. 1 (Theory)	Human Cytogenetics - Chromosomal basis of inheritance, sex chromosome, X-chromosome Inactivation	1 hr	
	Basics of cell culture - Techniques of cell cultures (short term lymphocyte, primary and secondary cell cultures, maintenance of cell lines)	1 hr	
	Techniques of chromosome analysis	1 hr	
	Chromosome preparation from cultured lymphocytes, cell lines and solid tumors ,	1 hr	
	Karyotyping - C-,G-banding and fluorescence banding, nomenclatures of bandings,	1 hr	
	In-situ hybridization techniques – FISH and GISH,	1 hr	
	Chromosomal anomalies and disorders - Numerical variations (polyploidy, Aneuploidy)	1 hr	
	Chromosomal anomalies and disorders - autosomal, sex-chromosomal	1 hr	
	Chromosomal anomalies and disorders - Structural variations (deletion, duplication, translocation, inversion, isochromosome, ring chromosome)	1 hr	
	Chromosomal abnormalities in cancer.	1 hr	
	Genetic disorders: Classification of genetic disorders,	1 hr	
	Single gene Disorders - Sickle cell anaemia,	1 hr	
	Single gene Disorders - Duchenne muscular Dystrophy	1 hr	
	Single gene Disorders - Retinoblastoma, Cystic Fibrosis	1 hr	
	Single gene Disorders - Marfan's syndrome	1 hr	
	Multifactorial disorders - Diabetes,	1 hr	
	Multifactorial disorders - Atherosclerosis,	1 hr	
	Multifactorial disorders – Schizophrenia	1 hr	
	Sex – linked inherited disorders.	1 hr	
Cancer genetics - Molecular basis of cancer, oncogenes, tumour suppressor genes.	1 hr		
Allelic susceptibility test for multifactorial disorders (Neural Tube Defect, Cleft Lip and	1 hr		

	Palate, Cardio Vascular Disorder, Male infertility)		
	Risk evaluation (Mendelian risk, empirical risk),	1 hr	
	Non-invasive Prenatal and pre-implantation diagnosis : - Triple test, Ultrasonography (USG),	1 hr	
	Invasive Prenatal diagnosis. -: Amniocentesis (AC), chorionic villi sampling (CVS), Fetal blood sampling (FBS),	1 hr	
	Population screening for genetic disorders,	1 hr	
	Overview of immune system - Antigens and antibodies, Antigen-antibody interactions,	1 hr	
	Major Histocompatibility Complex (MHC), HLA typing	1 hr	
	Immune Disorders	1 hr	
	Immunodiagnosics - Introduction, antigen-antibody binding interactions and assays; antibodies polyclonal and monoclonal antibodies,	1 hr	
	Immunoassays – types [RIA, ELISA, ChemiluminescentIA, FIA] and specific applications;	1 hr	
	Immunohistochemistry – principle and techniques.	1 hr	
A	Total Hours And Credit	30 hrs	2
Module No. 2 (Practical)	Metaphase chromosome preparations from bone marrow of mouse, rat, cultured Lymphocytes	1 hr	
	Chromosome preparation from lymphocyte culture / mouse bone marrow	1 hr	
	Karyotype using Human lymphocyte culture	1 hr	
	a. Q-banding	1 hr	
	b. G-banding	1 hr	
	Fluorescence <i>in-situ</i> Hybridization (FISH)	1 hr	
	Automated Karyotyping	1 hr	
	Sex chromatin (buccal mucosa, hair bud)	1 hr	
	Comet assay	1 hr	
	Micronucleus assay – bone marrow of mouse and cultured lymphocytes	1 hr	
	Chromosome preparation from chorionic villi, stem cells, cell line	1 hr	
	Sister Chromatid Exchange (SCE)	1 hr	
	Study of Chromosomal Aberrations in Mice	1 hr	
	Meiotic Chromosome preparations from testis	1 hr	
	Flowcytometry.	1 hr	

	Characterization of Proteins by SDS-PAGE	1 hr	
	Characterization of Proteins by 2D Gel Electrophoresis	1 hr	
	Purification of proteins by HPLC	1 hr	
	Immunological methods – Agglutination (ABO – Blood group)	1 hr	
	Immunological methods- (Bacterial)	1 hr	
B	Total Hours And Credit	20 hrs	0.5
A + B	Total Hours And Credit	50 hrs	2.5

Hours And Credits Summary of The Course

Sr.	Course Details	Hours	Credits
1	Theory	82	5
2	Practical	50	1.5
3	Internship	30	2
	Total	152	8