B. Voc. (Medical Laboratory Technology)

SEMESTER- V

S. No.	Component	Title of The Paper	Paper Code	Credits	Marks (Theory)		Marks (Practical)		Total
					External Assessment	Internal Assessment	External Assessment	Internal Assessment	
1.	Skill Paper - 1	Histopathology & Cytology (Theory)	BVML511CCT	04	70	30	---	---	100
		Histopathology & Cytology (Lab.)	BVML511CCP	02	---	---	35	15	50
2.	Skill Paper - 2	Molecular Diagnostics (Theory)	BVML512CCT	04	70	30	---	---	100
		Molecular Diagnostics(Lab.)	BVML512CCP	02	---	---	35	15	50
3.	Skill Paper - 3	Virology (Theory)	BVML513CCT	04	70	30	---	---	100
		Virology (Lab.)	BVML513CCP	02	---	---	35	15	50
4.	Non-Skill Paper - 4	Nutritional Biochemistry(Theory)	BVML514CCT	04	70	30	---	---	100
		Nutritional Biochemistry(Lab.)	BVML514CCP	02	---	---	35	15	50
5.	Non-Skill Paper - 5	Research Methodology and Biostatistics(Theory)	BVML515CCT	04	70	30	---	---	100
		Research Methodology and Biostatistics(Lab.)	BVML515CCP	02	---	---	35	15	50
		Total		**30**					**750**

B. Voc. (Medical Laboratory Technology)

SEMESTER-V

(Skill Paper - 1) Histopathology & Cytology (Theory)

Credits – 04

Objective — The students will learn about the techniques to study the structural changes in cells and tissues obtained by aspiration, biopsy or autopsy .

Outcome intended : At the end of the semester the student will be able to perform sample handling , preservation , tissue processing , routine and special staining procedures.

Unit I

Introduction to histotechnology – Cells, Tissue ,organs and their functions -- Different human organs and their gross and histological structure and functions --- Collection of specimen -- tissue biopsies , cytological samples , FNAC , autopsy ,Fixation -- Classification of fixatives, Simple Fixatives and their properties --processsing bone tissue –Decalcification, procedure and chemicals used

Unit II

Tissue processing—manual & automated tissue processing fixation-- Dehydration---- Clearing -- Impregnation --Embedding--Paraffin block making --- Section Cutting---- Microtomes and microtome knives -- types --- use and care-- sharpening of knife – Honing—Stropping—Technique of section cutting Frozen section.

Unit III

Priniples of staining—Dyes and stains used in histopathology --Staining with Haematoxylin and Eosin --Congo red-- methyl violet-- Leishman stain —Giesma — Special stains ----VG - PAS ---Masson's trichrome , Gomori's trichrome -- Perl' Prussian blue -- Alcian blue --- Reticulin stain

Unit IV

Introduction to Cytology ---- Fine needle aspiration cytology (FNAC) - Exfoliative Cytology --Sample collection -- sputum, BAL, CSF, Pleural, peritoneal and pericardial fluid, Gynaecologic samples preservation and fixation of samples Liquid Based Cytology LBC - Staining methods --- Papanicolaou's staining technique -MGG staining --- H & E staining --- Cytospin technique -- cell block preparation

Essential reading :

1. Dr. D.R. Singh (2003) Principles & Techniques in Histology , Microsopy and Photomicrography .
2. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications

Suggested Reading :

1. Techniques Histopathology & Cytopathology , A guide for medical laboratory students, Sadhana Vishwakarma, Jun 2017

B. Voc. (Medical Laboratory Technology)

SEMESTER-V

(Skill Paper - 1) Histopathology & Cytology (Lab/Practical)

Credits – 02

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1. Collection, preservation & fixation of specimen in laboratory.
2. FNAC procedure & precautions.
3. Tissue processing & its steps.
4. Various stainings performed in Histopathology & cytology.

B. Voc. (Medical Laboratory Technology)

SEMESTER-V

(Skill Paper - 2) Molecular Diagnostics (Theory)

Credits – 04

Objective – the student will learn about the genomic organisation , variation and the techniques used in detection of these variations

Outcome intended : At the end of the semester the student will develop an insight into the molecular disgnostic techniques used in the detection of infectious disease , cancers, genetic disorders and forensic testing.

UNIT I : Organization of the Genome

Molecular composition and structure, Pathway for the transfer of genetic information, Chromosome structure, Structure of gene, Replication of DNA, Transcription of DNA to RNA, Translation, Transcriptional control, The operon concept, DNA repair, DNA mutations.

UNIT II : Molecular Biology Techniques

Nucleic acid extraction, Hybridization assays, DNA amplification techniques — Fundamentals of polymerase chain reaction, Restriction Fragment Length Polymorphism.

UNIT III : Applications of Molecular diagnostics

Diagnosis of cancer by using molecular techniques, Molecular diagnosis of genetic diseases, Forensic identity testing (Parentage testing, DNA finger printing). **Molecular genetics** Salient features of genetic code Protein biosynthesis – eukaryotic Semiconservative DNA replication, Transcription , Translation Mutations & cancer

UNIT IV : Cytogenetics

Use of cell culture for cytogenetic studies, General method of preparation of cell culture, Study of constitutional chromosome patterns.

Essential reading :

1. Tietz Textbook of clinical Chemistry and Molecular Diagnostics , 5th ed
2. Laboratory Manual for Molecular Genetic Tests, Madhumita Roy Chaudhary

Suggested reading :

1. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications

B. Voc. (Medical Laboratory Technology)

SEMESTER-V

(Skill Paper - 2) Molecular Diagnostics (Theory)

Credits – 02

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1. Isolation of Nucleic acid
2. Separation of Nucleic acid by Agarose gel Electrophoresis
3. Demonstration of Polyacrylamide gel Electrophoresis
4. Demonstration of Thermal cycler & PCR
5. Demonstration of Flowcytometry.

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SEMESTER-V

(Skill Paper - 3) Virology (Theory)

Credits – 04

Unit 1:

Introduction to Virology, Classification of virology, General properties and cultivation, viral host interaction, Growth and replication, Lab diagnosis of viral infections.Bacteriophage, Pox viruses, Herpes viruses (HSV, Varicella-Zoster, Cytomegalo virus, Epstein-Barr virus), Adeno viruses, Picornaviruses, Enteroviruses (Polio virus, Echo viruses), Rhinoviruses, Orthomyxo viruses (Influenza virus), Paramyxo viruses (Parainfluenza virus, Mumps, Measles, RSV).

Unit 2:

General characteristics of virology, classification of virology, lab diagnosis of viral infections, cultivation of viruses, bacteriophage, HIV, hepatitis virus, pox virus, polio, influenza, chikungunya, dengue, adeno virus, DNA and RNA containing virus, general transmission routes of virus. **RNA** Viruses: Poliomyelitis, Coxsackie viruses, Rhinoviruses, Influenza, Rabies, Arboviruses, Measles, Mumps, Rubella, HIV, Rotavirus. **DNA** Viruses: Smallpox, Herpes simplex, Varicella Zoster, CMV, EBV, Adenoviruses, Hepatitis Viruses.

UNIT 3:

Common viral diseases, mode of transmission of infection, Laboratory diagnosis, viruses causing gastroenteritis, Arboviruses Discuss in detail Chikungunya, Dengue, KFD, Enumerate remaining arbovirus with disease caused Rhabdoviruses, Hepatitis viruses, HIV, Papova virus, Parvovirus, Corona virus, Rubivirus, Rotavirus, Norwalk virus, Astro Virus, Viral hemorrhagic fevers, SARS, Slow viruses.

UNIT 4:

Oncogenic viruses, prevention and control of viral diseases,- Interferons, elementary knoqwledge of Viral vaccines, Phage typing.

B. Voc. (Medical Laboratory Technology)

SEMESTER-V

(Skill Paper - 3) Virology (Lab/Practical)

Credits – 02

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1. Demonstration of cell culture techniques
2. Demonstration of animals models for studying viral infections.
3. Demonstration of ELISA
4. Sterilisation of glasswares by dry heat and high pressure steam.

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SEMESTER-V

(Non - Skill Paper - 4) Nutritional Biochemistry (Theory)

Credits – 04

Unit I –Nutrition:

Importance of Nutrition**:** Calorimeter- Energy values, Respiratory Quotient & its significance, Specific Dynamic action of Food, BMR, Factors affecting BMR, Food and energy expenditure for various activities, Nutritional importance of Carbohydrates, Lipids and Proteins, Assessment of Nutritive values: Biological value, Protein efficiency rate, NPU, Chemical score, RDA, Balanced Diet, Composition of Food and Nutritional supplementation, Nutritional Disorders: Marasmus and Kwashiorkor, Nutritional Anemia.

Unit II –Vitamins:

Definition, History and Nomenclature, Classification of Vitamins according to solubility, Individual Vitamins (Water soluble and Fats soluble): Chemistry, Dietary sources, Digestion absorption and Transport, Biochemical Functions, RDA, Deficiency disorders and Toxicity.

Unit III –Minerals:

Definition, General Functions, Classification of Minerals (Macro and Micro), Individual Minerals, Calcium, Phosphate, Magnesium, Sodium, Potassium, Chloride, Sulfur, Iron, Copper, Iodine, Manganese, Zinc, Fluorine, Selenium, Biochemical Functions, RDA, Dietary Sources, Absorption, Transport, Excretion, Normal Concentration and disease states.

Unit IV –Water, Electrolytes and Acid Base Balance:

Body Water, Distribution of water, Water Turnover and Balance, Osmolarity, Osmolality, Composition of Electrolytes in the body fluids, Regulation of Water and Electrolytes Balance, Dehydration, over hydration, Buffers, PH, Acid-Base Balance, Buffer systems in the Blood, Role of Lungs and kidneys in acid base balance, Disorders of Acid Base Balance, Blood Gas measurement.

B. Voc. (Medical Laboratory Technology)

SEMESTER-V

(Non - Skill Paper - 4) Nutritional Biochemistry (Lab/Practical)

Credits – 02

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1. Estimation of Serum Calcium
2. Estimation of Vitamin D
3. Estimation of Electrolytes
4. Estimation of Vitamin B12
5. Estimation of folic acid / iron
6. Metabolic Acidosis / Alkalosis
7. Respiratory Acidosis/ Alkalosis

B. Voc. (Medical Laboratory Technology)

SEMESTER-V

(Non - Skill Paper - 5) Research Methodology and Biostatistics (Theory)

Credits – 04

Unit	**Teaching Guidelines**	**Hours (65)**
1.Introducti on research methodology	Introduction to research methods,	10
	Variable in research	
	Reliability and validity in research	
	Conducting a literature review	
	Formulation of research problems and writing research questions	
	Hypothesis, Null and research Hypothesis, Type I and type	
	II errors in Hypothesis testing	
2.Data collection	Experimental and non experimental research designs,	5
	Sampling methods, data collection, observation method,	
	Interview method, questionnaires and schedules construction	
3.Research Frame work	Ethical issues in research Principles and concepts in research ethics-confidentiality and privacy informed consent Writing research proposals Development of conceptual framework in research	5
4.Introduction to statistics	Introduction to statistics	5
	Classification of data, source of data,	
	Method of scaling- nominal, ordinal, ratio and interval scale	
	Measuring reliability and validity of scales	
5.Data sampling	Measures of central tendency,	10
	Measures of dispersion, skewness and kurtosis, sampling, sample size determination.	
	Concept of probability and probality distributions- binomial probability distribution, poison probability distribution and normal probability distribution	
6.Data correlation	Correlation-Karl person, spearman’s rank correlation methodsregression analysis, testing hypothesis-chi square test, student’s test, NOVA	5

B. Voc. (Medical Laboratory Technology)

SEMESTER-V

(Non - Skill Paper - 5) Research Methodology and Biostatistics (Lab/Practical)

Credits – 02

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1. Introduction to research methods

2. Identifying research problem

3. Ethical issues in research

4. Research design

5. Basic Concepts of Bio statistics

6. Types of Data

7. Research tools and Data collection methods

8. Sampling methods

9. Developing a research proposal