

SAURASHTRA UNIVERSITY

RAJKOT – INDIA



**Re-Accredited
Grade B by NAAC
(CGPA 2.93)**

CURRICULAM FOR

UGC - B.Voc. under National Skills Qualification Framework(NSQF)

**Bachelor of Vocation – Medical Laboratory and Molecular
Diagnostics Technology**

(B.Voc.- MLMDT)

(Sanctioned to Shree Manibhai Virani & Smt. Navalben Virani Science College-Rajkot)

(Semester III and Semester IV)

Effective From June – 2015

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

B. Voc. - Medical Laboratory and Molecular Diagnostics Technology
(Semester – III)

Sr. No.	Paper No.	Subject	Component	Credit
1	MLMDT 3.1	Immunology & Serology	Skill	5
2	MLMDT 3.2	Endocrinology, Tumor & Cancer markers	Skill	5
3	MLMDT 3.3	Clinical Biochemistry	Skill	5
4	MLMDT 3.4	Practical	Skill	12
5	GMLMDT 3.5	Introduction to Bioinformatics & Biostatistics	General education	3
Total Credits of Semester - III				30

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

MLMDT 3.1 : Immunology and serology				
Unit	Topic	Detail	Marks	Min Lec.
1	Introduction to immune system	Innate and adaptive immunity Cells and tissues of immune system Functions of lymphoid tissue Antigen: Immunogenicity versus antigenicity Properties of immunogen Hapten, adjuvants, epitopes		10
2	Antibody and MHC	Basic structure of antibody Major classes and their biological activity Antigenic determinants Structure, function relationships in antibody Major histocompatibility complex-MHC Structure and properties of class I and II MHC Expression of MHC molecule Overview of monoclonal antibody		12
3	Immune response	Antigen processing and presentation Cytosolic pathway for exogenous antigen Endocytic pathway for exogenous antigen Cell mediated immune response T-cell activation and differentiation Cytotoxic T cells and its functions Humoral response B-cell activation and differentiation Complement system		12
4	Immune system in health and disease	Dysfunctional immunity Hypersensitivity reactions- Type I to Type IV reactions Immunodeficiency diseases Autoimmune diseases Transplantation immunology		10
5	Vaccine	Active and passive immunization Designing of vaccine for active immunization Live attenuated vaccine, Inactivated vaccine DNA vaccine, Recombinant vector vaccine Cancer and immune system Immune response to tumors Immunotherapy		8

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

6	Serological reactions	Antigen antibody reactions Precipitation reactions Agglutination reactions Radioimmunoassay and ELISA Western blotting reactions Immunofluorescence Flowcytometry		8
		Total	100	60

Student Seminar – 5 Lectures
Expert Talk – 5 Lectures
Student Test – 5 Lectures
Total Lectures 60 + 15 = 75

Reference Books:

No	Title	Author	Publisher
1	Serology and immunology-A clinical approach	William Stanford	MacMillan
2	Immunology	Jennis Kuby	WH Freeman
3	Cellular and Molecular Immunology	Abul Abbas	Saunders
4	Basic and clinical immunology	Daniel Stites	Lange

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

MLMDT 3.2 : Endocrinology, tumor and cancer markers				
Unit	Topic	Detail	Marks	Min Lec.
1	Introduction to Endocrinology	Definition of hormone, Endocrine gland, Exocrine and paracrine glands Chemical nature of hormones Classification Mode of hormone action-receptors, secondary Messengers-cAMP, GMP Hormone assay and analysis		8
2	Hypothalamus and pituitary gland	Anatomy, Chemistry and functions of hypothalamus Regulations and diseases related to hormones of these gland TRH, GHRH, GnRH, CRH, Somatostatin, dopamine Pituitary gland- Anatomy, Chemistry and functions-GH, Prolactin, FSH, LH, ADH Neurohypophyseal hormones Pineal gland- Morphology and hormones		12
3	Thyroid and parathyroid glands	Anatomy, Chemistry and functions, secretion and metabolism of thyroid and parathormones Regulation of thyroid hormones Pathophysiology of the thyroid hormones- Diseases related to these glands		10
4	Adrenal gland	Anatomy, Chemistry and functions and regulations of Adrenocortical hormones Adrenal medulla hormones Pathophysiology of these hormones Addison's disease, Cushing's syndrome		8
5	Gastrointestinal and pancreatic hormones	Structure and cell types of islets of Langerhans of pancreas Secretion of insulin, glucagon and other hormones- Functions and Pathophysiology of these hormones- Diabetes mellitus Gastrointestinal hormones- Gastrin, CCK, Secretin- Functions and regulation		6
6	Reproductive hormones	Male and female reproductive hormones Testosterone, Estrogen, Progesterone and others synthesis and functions Human chorionic gonadotropin Functions, regulation and Pathophysiology related to reproductive hormones		7

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

7	Tumor and cancer markers	<p>Oncogene-definition- Mechanism of action of Oncogenes (outline) Characteristics of growing tumor cells-general and morphological changes, biochemical changes Tumor Markers- Introduction and definition Clinical applications of tumor markers. Enzymes as tumor markers Prostate specific antigens (PSA) Oncofetal antigens, Alpha feto protein (AFP) Carcino embryonic antigen (CEA) Squamous cell carcinoma (SCC) antigen. Carbohydrate markers (brief introduction of each type) CA 15-3, CA 125, CA 19-9, CA 50, CA 72-4, CA 242 Bladder cancer markers (introduction in brief) - Bladder tumor antigen (BTA) Fibrin- Fibrinogen degradation product (FDP) Nuclear matrix protein (NMP22). Biomarkers still in research (introduction in brief)- Telomeres, TRAP assay, hyaluronic acid and Hyaluronidase</p>		9
		Total	100	60

Student Seminar – 5 Lectures
Expert Talk – 5 Lectures
Student Test – 5 Lectures
Total Lectures 60 + 15 = 75

Reference Books:

No	Title	Author	Publisher
1	Basic and clinical endocrinology	Francis Greenspan	Prentice-Hall
2	Textbook of medical biochemistry	M N Chatterjea	Jaypee
3	Textbook of endocrinology	Mala Dharmalingam	Jaypee
4	Concise book of medical laboratory technology-Methods and interpretations	Ramnik Sood	Jaypee

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

MLMDT 3.3 : Clinical Biochemistry				
Unit	Topic	Detail	Marks	Min Lec.
1	Metabolic disorders of carbohydrates	Overview of carbohydrate metabolism Hyperglycemia- metabolic defect Type I and II Diabetes mellitus Causes, incidence, risk factors, biochemical basis and diagnosis, Complications Hypoglycemia- metabolic defect Diabetes profile		12
2	Metabolic disorders of lipid	Hypercholesterolemia, hypertriglyceridaemia Atheroma and heart disease, coronary artery disease Causes, incidence, risk factors, biochemical basis and diagnosis Lipid profile		12
3	Metabolic disorders of protein and nucleic acid	Phenyl ketone uria and alkaptonuria Maple syrup urine disease Hyperuricemia Gout- Metabolism defect, symptoms and diagnosis		8
4	Liver function and renal function test	Functions of liver and diseases of liver Jaundice, hepatitis, cirrhosis Liver function test-plasma proteins, bilirubin, SGPT, SGOT, Alkaline phosphatase, gamma glutamyl transferase, Prothrombin time Renal function test Kidney diseases- Glomerulonephritis, nephrotic syndrome, diabetic nephropathy GFR, Urine analysis, serum urea, creatinine		12
5	Clinical enzymology and biomarkers	Introduction to enzymes Clinical significance of enzyme assays Serum enzymes in heart diseases Serum enzymes in muscle diseases Serum enzymes in GI tract diseases, bone diseases and malignancies Isoenzymes- significance of different isoenzymes LDH, CPK,ALP Biomarkers-Proteins as biomarkers in cardiac diseases- troponin, natriuretic peptide		9

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

6	Water-electrolyte and acid-base balance and imbalance	Water homeostasis Assessing fluid and electrolyte status Disturbances of plasma sodium and potassium Acid, base and buffers Classification of acid-base disorders Respiratory acidosis and alkalosis Metabolic acidosis and alkalosis		9
7	Disorders of calcium, phosphate and Mg homeostasis	Distribution, functions and regulation of Ca, PO ₄ and Mg Disorders of Ca, PO ₄ and Mg homeostasis Bone metabolism Markers of bone diseases Metabolic bone disease		8
		Total	100	60

Student Seminar – 5 Lectures
 Expert Talk – 5 Lectures
 Student Test – 5 Lectures
Total Lectures 60 + 15 = 75

Reference Books:

No	Title	Author	Publisher
1	Clinical biochemistry	Nessar Ahmed	Oxford
2	Textbook of medical biochemistry	M N Chatterjea	Jaypee
3	Clinical Chemistry	M N Chatterjea	Jaypee
4	Lehninger Principles of Biochemistry	Nelson LD and Cox MM	

MLMDT 3.4 : Practical	
Paper	Marks
MLMDT 3.1	100
MLMDT 3.2	100
MLMDT 3.3	100
GMLMDT 1.5	50
Total	350

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

GMLMDT 3.5 : Introduction to Bioinformatics & Biostatistics				
Unit	Topic	Detail	Marks	Min Lec.
1	Introduction to biostatistics	Origin of the word Applications of biostatistics Important terms used in biostatistics		4
2	Data Collection and presentation	Sampling methods Random and nonrandom sampling Graphical presentation of data		10
3	Probability distributions	Concept of probability Laws of probability Normal distribution Binomial distribution Poisson distribution		8
4	Measures of central tendency and dispersion	Characteristics of a good average Mean, median and mode Measures of dispersion- Range, mean deviation, standard deviation, variance		8
5	Hypothesis testing	Tests of hypothesis Types of hypothesis Tests of significance for small samples- student's t test, F test, Chi-square test ANOVA test		12
6	Correlation and regression analysis	Utility of correlation test, types of correlation Methods to study correlation analysis Use of regression analysis Methods of regression analysis		8
7	Introduction to bioinformatics	Introduction and importance of Bioinformatics Database and DBMS: Introduction, File formats, Primary and Secondary biological databases, Structure databases, miscellaneous databases Information retrieval from Biological database : ENTREZ, SRS and DBGET Sequence Alignment : BLAST and FASTA Introduction to OMICS technology Introduction to Drug discovery		10
		Total	100	60

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

Student Seminar – 5 Lectures
Expert Talk – 5 Lectures
Student Test – 5 Lectures
Total Lectures 60 + 15 = 75

Reference Books:

No	Title	Author	Publisher
1	Applied statistics in health sciences	Nsn Rao	Jaypee
2	Fundamentals of biostatistics	Khan and Khanum	
2	Introduction to Bioinformatics	Attwood & Parry. D.J	
3	Bioinformatics	Andreas. D., & Baxevanis	

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

B. Voc. - Medical Laboratory and Molecular Diagnostics Technology
(Semester – IV)

Sr. No.	Paper No.	Subject	Component	Credit
1	MLMDT 4.1	Immunohaematology & Blood Banking Techniques	Skill	5
2	MLMDT 4.2	Histopathology & Cytology techniques	Skill	5
3	MLMDT 4.3	Systemic Bacteriology, Mycology & Virology	Skill	5
4	MLMDT 4.4	Practical	Skill	12
5	GMLMDT 4.5	Value Education	General education	3
Total Credits of Semester - IV				30
One month training in Pathological Laboratory				

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

MLMDT 4.1 : Immunohematology and blood banking				
Unit	Topic	Detail	Marks	Min Lec.
1	Concept of immunohematology	Definition of immunohematology Antigens and antibodies in the blood Antigen-antibody reaction in vitro Complement fixation test		12
2	Blood group system	ABO blood group system and ABO variant Genetics and inheritance of blood groups Rh blood group system and other blood group systems Laboratory detection of antibodies and antigen- Blood grouping techniques- Cell grouping and Serum grouping Antiserum used in ABO test procedures, Anti –A, Anti-B Anti- AB Antiserum		12
3	Blood transfusion practice	Types of transfusion, main objective of blood transfusion, Special transfusion practice Hazards of transfusion –transfusion transmitted diseases, Hemolytic transfusion reaction Investigation of a Transfusion reaction Actions to take when transfusion reaction occurs Hemolytic disease of new born		8
4	Blood banking	Functions of blood bank, Design, components of blood bank Blood donor- screening criteria, collection of blood and post collection processing Blood donation record book, Blood donor card Storage, preservation- various anticoagulants Cross matching techniques Issue of blood in emergency life saving situation Issue of blood in neonate and infants		12
5	Blood component separation and use	Apheresis procedure Blood components-red cells, white cells, platelets, coagulation factors, FFP, Cryoprecipitate etc. Advantages of blood component therapy		9

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

6	Quality control in blood bank	Quality building blocks, Potential problems and errors, Documents and record QC of reagents, equipments, QC in blood collection, storage of blood, Medical audit Personal care and hygiene, Handling, transfer and shipment of samples, disposal of wastes and discard		9
7	HLA system	Historical perspective Antigen and antibodies HLA gene products Techniques of histocompatibility testing Clinical significance of HLA system		8
		Total	100	60

Student Seminar – 5 Lectures
 Expert Talk – 5 Lectures
 Student Test – 5 Lectures
Total Lectures 60 + 15 = 75

Reference Books:

No	Title	Author	Publisher
1	Modern blood banking and transfusion practice	Denise Harmening	Jaypee
2	Blood transfusion a basic text	Anthony Britten	AITBS
3	A textbook of blood banking and transfusion medicine	VH Talib	CBS
4	A textbook of blood bank and transfusion medicine	Satish Gupte	Jaypee

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

MLMDT 4.2 : Histopathology and cytology				
Unit	Topic	Detail	Marks	Min Lec.
1	Introduction to Histopathology	Fundamentals of normal histology and histopathology Overview of tissue seen in normal histology Epithelium, muscle, nervous and connective tissue Basic histopathology- non tumor pathology Tumor pathology		8
2	Basic steps for Tissue Processing	Fixing of tissues Embedding in wax Microtomy- preparation of slides Staining-Hematoxylin and eosin staining Mounting of slides for microscopic observation Methods of decalcifications		12
3	Equipments for histology techniques	Microscope, Microtome -Types, Uses, Parts, different types of microtome knives, care & maintenance Automated tissue processor - components, working & precautions during use, Tissue floating bath		10
4	Staining Methods	Hematoxylin & Eosin stain, Hematoxylin - Types, methods of preparation, staining, Eosin - method of preparation Reticulin stain, PAP staining components & methods		8
5	Enzyme histochemistry	Immunohistochemistry and the various immunohistochemical stains in the diagnosis of various disorders Tissues of special interest – nervous system, Hard tissue, Endocrine cells		8
6	Museum Techniques	The mounting of pathological specimens - Preparation of specimen, Fixation of specimen- Kaiserling solution-1 & Kaiserling solution-2 Precaution taken for the Fixation of Specimens Storage of Specimens Mounting of Museum Specimens Routine Mounting of Specimens Filling and Scaling		6
7	Exfoliative Cytology	Specimen collection,Preparation of specimen Fixation , Staining of exfoliated cells by Papanicolaou method Differentiation between normal and abnormal cells		8
		Total	100	60

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

Student Seminar – 5 Lectures
Expert Talk – 5 Lectures
Student Test – 5 Lectures

Total Lectures 60 + 15 = 75

Reference Books:

No	Title	Author	Publisher
1	Manual of histological techniques and their diagnostic application	John Bancroft	Churchill livinstone
2	Concise book of medical laboratory technology-Methods and interpretations	Ramnik Sood	Jaypee
3	Clinical diagnosis and management by laboratory methods	John Bernard henry	Saunders
4	Textbook of medical laboratory technology	Praful Godkar	Bhalani

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

MLMDT 4.3 : Systemic Bacteriology, Mycology & Virology				
Unit	Topic	Detail	Marks	Min Lec.
1	Gram positive and gram negative cocci	Staphylococci, pneumococci, streptococci N. gonorrhoeae, N. meningitides Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & lab diagnosis		12
2	Gram positive bacilli	Corynebacteria, Mycobacteria, Clostridia, Actinomycetes , Bacillus Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & lab diagnosis		12
3	Gram negative bacilli	Enterobacteriaceae, Pseudomonas, Vibrio, Brucella, Bordetella, Haemophilus, Yersinia Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & lab diagnosis		8
4	Miscellaneous bacteria	Spirochetes – Treponema, Leptospira, Borrelia Rickettsiae, Chlamydiae Morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused & lab diagnosis		12
5	Introduction to Virology	Classification and general properties of viruses – interferon, inclusion bodies Cultivation of viruses and laboratory diagnostic methods of viral diseases		9
6	Viral diseases	Pox virus, herpes virus, myxoviruses, enteroviruses Rabies, Arbo viruses, hepatitis, HIV, viruses causing gastro enteritis, miscellaneous viruses		9
7	Mycology	General properties of fungi, cultivation methods, laboratory methods of diagnosing fungal infection.		8
8	Fungal diseases	Superficial and deep fungal infections, opportunistic fungal infection. Mycotoxins		
		Total	100	60

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

Student Seminar – 5 Lectures
 Expert Talk – 5 Lectures
 Student Test – 5 Lectures

Total Lectures 60 + 15 = 75

Reference Books:

No	Title	Author	Publisher
1	Medical microbiology	David Greenwood	ELBS
2	Medical Microbiology	Michel Ford	IBMS
3	Diagnostic microbiology	Ellen Baron	Mosby
4	Medical Microbiology	Anant Narayan	Jaypee
5	Essentials of medical microbiology	Rajesh Bhatia	Jaypee

MLMDT 4.4 : Practical	
Paper	Marks
MLMDT 4.1	100
MLMDT 4.2	100
MLMDT 4.3	100
Total	300

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

GMLMDT 4.5 : Value Education				
Sr. No.	Topics	Details	Marks	Lec.
1	Introduction to Value Education	<ul style="list-style-type: none"> • understanding the need, basic guidelines content and process for Value Education • Self-exploration – its content and process; ‘Natural Acceptance’ and Experiential Validation – as the mechanism for self-exploration • Continuous Happiness and Prosperity – A look at basic human aspirations • Right understanding, Relationship and Physical Facilities – The basic requirements for fulfillment of aspirations of every human being • Understanding Happiness and Prosperity aspirations: Understanding and living in harmony at various levels • Method to fulfill the above human aspirations: Understanding and living in harmony at various levels 		12
2	Harmony in the Human Being	<ul style="list-style-type: none"> • Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’ • Understanding the needs of Self(‘I’) and ‘Body’ – <i>sukh</i> and <i>savidha</i> • Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer) • Understanding the characteristics and activities of ‘I’ and harmony in ‘I’ • Understanding the harmony of ‘I’ with the Body: <i>Sanyam</i> and <i>Swasthya</i>; correct appraisal of physical needs, meaning of prosperity in detail • Program to ensure <i>Sanyam</i> and <i>Swasthya</i> 		12

Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015

3	Harmony in the Family and Society	<ul style="list-style-type: none"> • Understanding harmony in the Family – the basic unit of human interaction • Understanding values in human-human relationship; meaning of <i>Nyaya</i> and program for its fulfillment to ensure <i>Ubhay – tripti</i>; Trust (<i>Vishwas</i>) and Respect (<i>Samman</i>) as the foundational value of relationship • Understanding the meaning of <i>Vishwas</i>; Difference between intention and competence • Understanding the meaning of <i>Samman</i>, Difference between respect and differentiation; the other salient values in relationship • Understanding the harmony in the society (society being an extension of family): <i>Samadhan</i>, <i>Samridhi</i>, <i>Abhay</i>, <i>Sah-astitva</i> as comprehensive Human Goals • Visualizing a universal harmonious order in society – Undivided Society (<i>Akhand samaj</i>), Universal Order (<i>Sarvabhaum Vyavastha</i>) from family to world family. 	12
4	Harmony in the Nature (Existence)	<ul style="list-style-type: none"> • Understanding the harmony in the Nature • Interconnectedness and mutual fulfillment among the four orders of nature – recyclability and self-regulations in nature • Understanding existence as co-existence (<i>Sah-astitva</i>) of mutually interacting units in all-pervasive space • Holistic perception of harmony at all levels of existence 	12

**Bachelor of Vocation – Medical Laboratory and Molecular Diagnostic Technology
(Semester –III & IV)
Saurashtra University
Effective from June - 2015**

5	Implications of the Holistic Understanding – A Look at Professional ethics	<ul style="list-style-type: none"> • Natural acceptance of human values • Definitiveness of Ethical Human Conduct • Basis for Humanistic Education, Humanistic Constitution and Universal Human Order • Competence in Professional Ethics: <ul style="list-style-type: none"> ○ Ability to utilize the professional competence for augmenting universal human order, ○ Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models • Case studies of typical holistic technologies, management models and production systems • Strategy for transition from the present state to Universal Human Order: <ul style="list-style-type: none"> ○ At the level of individual: as socially and ecologically responsible engineers, technologist and managers ○ At the level of society: as mutually enriching institutions and organizations 	12	
		Total	100	60

Student Seminar – 5 Lectures
 Expert Talk – 5 Lectures
 Student Test – 5 Lectures

Total Lectures 60 + 15 = 75

Reference Books:

1. Human Values and Professional ethics – Teacher’s Manual By R.R. Gaur, R Sangal G.P. Bagaria - Excel Books
2. Human Values and Professional ethics By R.R. Gaur, R Sangal G.P. Bagaria - Excel Books