AC- 06/04/2024

Item No-4.12

Rayat Shikshan Sanstha's

KARMAVEER BHAURAO PATIL COLLEGE VASHI

(**AUTONOMOUS COLLEGE**)

Sector-15- A, Vashi, Navi Mumbai - 400 703

Syllabus for T.Y.B.Sc. Medical Laboratory Tech.

Technology Program: Medical Laboratory Tech.

Course: T.Y.B.Sc. Medical Lab Technology

(Choice Based Credit, Grading and Semester System with effect from the academic year 2023-2024)

Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil College Vashi Autonomous College

Syllabus

Sr. No.	Heading	Particulars
1	**Title of Course**	**T.Y.B.Sc. Medical Laboratory Technology**
2	**Eligibility for Admission**	**12th Science and equivalent [of recognized Boards]**
3	**Passing Marks**	**40%**
4	**Ordinances/Regulations (if any)**	-----
5	**No. of Years/Semesters**	**One year/Two semester**
6	**Level**	**U.G.**
7	**Pattern**	**Semester**
8	**Status**	**Revised**
9	**To be implemented from Academic year**	**2022-2023**

Preamble

Medical Laboratory Technology is a branch of medical science responsible for performing laboratory investigations relating to diagnosis, treatment and prevention of disease. With this course, the basic aim is to provide students with knowledge and training that will enable them to work in various lab settings.

Educational Pedagogy:
The course design is based on NEP2020 guidelines where learner is given a choice to have vertical mobility while pursuing this program. His annualized credits earned will be banked to allow his subsequent year's enrollment. The three-year degree program is designed as –

- **1st year BSc with Certification in Phlebotomy**
- **2nd Year BSc with Adv Diploma in Medical Lab Technology &**
- **3rd Year BSc is with Degree in Medical Laboratory Technology**.

The pedagogical design is based on the core objective of making students job ready and hence a lot of focus is given in learner's engagement through Industry based skilling in Hospitals.
As anyone who seeks admission in this program comes from non-healthcare background, the course starts with the Foundation Course which is more like a platform setting to make learner understand the topicalities and Dos and Don'ts of Healthcare Organizations.
Industry interface is divided into 3 phases of learning as –

- Observership – Objective is to see what is being taught in the class room through clinical sessions on the subject.
- On The Job Training – Objective is to learn the job skills by working with someone.
- Internship – Working independently, but under supervision as per defined job role.

Considering that the program needs to empower job readiness of learners, a lot of focus is kept in active engaging Life Skills workshops. These cover topics like Self Awareness, Objective setting, Team Work, Leadership Development, Time Management, Communication Skills, Interpersonal abilities etc.
Program also focuses in creating a better path for students to pursue their higher education opportunities in healthcare sector. As such special skill enhancing modules like Basic Life Support, Bed Side Care, Hospital Administration and Public Health etc. are included in the curriculum. This will help learners to get into PG programs like Masters in Hospital Management or Masters in Hospital Administration or Masters in Public Health.
As regards to the Core expertise of the program on Lab Technology, key subjects that get covered are –

- **Phlebotomy**:

Phlebotomy, which is the science of drawing blood, from various sites, e.g., veins, arteries &capillaries, is among the most common procedures in healthcare and a core component ofdiagnosis and laboratory analysis.
Estimates indicate that nearly 70% of medical decisions are based on laboratory results which often rely on phlebotomy to produce a blood sample ready for laboratory analysis.
Despite the critical role of phlebotomy, there is an insufficient level of awareness among the Health Care Professionals about the International guidelines and understand the consequences to patients and their own safety from improper sample collection practices.

Poor Blood Collection Practices Introduce Serious Errors into Diagnosis and Laboratory Analysis.

- **Microbiology**:

The diagnostic microbiology laboratory procedures are essential for the diagnosis and treatment of infectious diseases. Microbiological pathogens are divided into bacteria, fungi, viruses, prions, and protozoa. Role of Microbiology is to isolate & identify the disease-causing micro-organism.
To train the students to conduct Antibiotic Sensitivity test to provide appropriate medical treatment (antibiotics) to the patients.

- **Hematology**:

Hematology concerns with the study of the cause, prognosis, treatment, and prevention of diseases related to blood.
It involves treating diseases that affect the production of blood and its components, e.g. blood cells, hemoglobin, blood proteins, bone marrow, platelets, blood vessels, spleen, the mechanism of coagulation & also blood parasites, e.g. Malaria
Such diseases might include hemophilia, blood clots (thrombus), other bleeding disorders, and blood cancers such as leukemia, multiple myeloma, and lymphoma.

- **Biochemistry**:

Biochemistry combines the two traditional disciplines of biology and chemistry. Biochemistry is the science of living matter.
Medical biochemistry teaches us about:
-The chemical components of the human body, e.g., carbohydrates and lipids; amino acids and proteins; nucleic acids (DNA and RNA), etc.
-The major chemical processes in the human body, Nutrition and mineral metabolism, Molecular genetics & Heredity

- **Clinical Pathology**:

This branch of Medical Laboratory Science deals with complete study of formation, the clinical significance of analyzing various body fluids, e.g., urine, stool, sputum, seminal fluid, CSF, pleural, peritoneal, pericardial & synovial fluids.

- **Histopathology & Cytology**:

Histopathology & Cytology provides a diagnostic service for cancer; it handles the cells and tissues removed from suspicious ‘lumps and bumps’, identify the nature of the abnormality
Histopathology is the examination of biological tissues in order to observe the appearance of diseased cells in microscopic detail.
Histopathology typically involves a biopsy, which is a procedure involving taking a small sample of tissue, processed by Histo-technologists and reported by the Pathologists

- **Immunology/serology**:

Different types of serologic tests are used to diagnose various disease conditions. Serologic tests have one thing in common. They all focus on proteins made by our immune system (antibodies)

Serological testing is very helpful in the diagnosis of certain bacterial, parasitic, and viral diseases, e.g., Typhoid, Dengue. Malaria, etc.
Serological testing has proved valuable mass-screening tool, as in the detection of diseases such as syphilis, HIV/AIDS, and epidemic and pandemic infectious diseases (e.g., influenza and coronavirus disease).

- **Blood Bank (Transfusion Medicine):**

A blood transfusion provides blood or blood components if patient has lost blood due to an injury, during surgery or have certain medical conditions that affect blood or its components. The blood typically comes from donors. Blood banks and healthcare providers ensure that the transfusions are a safe, low risk treatment.
The Transfusion Medicine Department is responsible for the collection and testing of blood to be given to patients (traditional "blood banking").
It also collects & processes hematopoietic stem cells for blood and bone marrow transplantation as well as the testing necessary for organ transplantation.

Key Objectives of this program:

- To implement NEP 2020 through this Vocational Skills development program
- Learners will inculcate right attitude, skills and knowledge to do the job role of Medical Laboratory Technologist as required by the industry.
- Program will also empower learners' abilities to pursue higher education in medical industry

After completing this program, learner will exhibit following skills and knowledge as Medical Laboratory Technologist:

- Demonstrate knowledge about the healthcare sector and diagnostic services
- Demonstrate the ability to perform clinical skills essential in providing basic diagnostic services such as Correctly collect, transport, receive, accept or reject and store blood /urine/stool and tissue samples.
- Conduct analysis of body fluids/ samples; Maintain, operate and clean Laboratory equipment; Provide technical information about test results
- Prepare and document medical tests and clinical results; etc.
- Demonstrate quality assurance in Laboratory works
- Practice infection control measures
- Demonstrate readily availability of medical and diagnostic supplies
- Demonstrate techniques to maintain the personal hygiene needs
- Demonstrate actions in the event of medical and facility emergencies
- Work as a medical laboratory professional with right attitude in any lab setting

Additionally, he will be developing following allied skills and knowledge through this program:

- CPR
- Care giver
- Basics on Hospital management
- Good communicator & allied health professional

Scheme of examination for Each Semester

Continuous Internal Evaluation: 40 Marks
Common Test 20 Marks & 20 Marks for Assignment, Projects, Group discussion, Open book test, online test etc. based on Units of each paper.

Semester End Examination: 60 Marks will be as follows –

I.	**Theory:** The Semester End Examination for theory course work will be conducted as per the following scheme.	
	Each theory paper shall be of two hours duration.	
	All questions are compulsory and will have internal options.	
	Q – I	Subject questions from Unit – I (having internal options.) 15 M
	Q – II	Subjective questions from Unit – II (having internal options.) 15 M
	Q – III	Subjective questions from Unit –III (having internal options.) 15 M
	Q – IV	Objective type questions based on all Units with equalweightage. 15 M
II.	**Practical**	The Semester End Examination for practical course work will be conducted as per the following scheme.

Sr. No.	**Particulars of Semester End Practical Examination**	**Marks%**
1	Laboratory Work	80%
2	Journal	10%
3	Viva	10%
	TOTAL	**100**

T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 5

Paper 1 [UGMLTC501]: Clinical Pathology				
Course Code	**Unit**	**Topics**	**Credits**	**L/week**
UGMLTDSE - 501	I	Urine Examination & Stool Examination	4	4
	II	Sputum & Seminal fluid Examination		
	III	Cavity fluid Examination		
Paper 2: [UGMLTC502]: Transfusion Medicine				
UGMLTDSE - 502	I	Immunohematology introduction, Red cell antigen-antibody	4	4
	II	Compatibility test, Cross matching		
	III	Blood banking techniques		
Paper 3: [UGMLTDSEC 503 A]: Histopathology/Cytology				
UGMLTDSE - 503A	I	Introduction & orientation to Histopathology and cytological techniques	4	4
	II	Preparation of tissue section for microscopy		
	II	Cytology, IHC		
Paper 4 [UGMLTDSEC 503 B]: Parasitology				
UGMLTDSE - 503B	I	Introduction to human Parasitology	4	4
	II	Medical Protozoology		
	III	Medical Helminthology		
Semester 5 Practical				
UGMLTCP-501 & 502		Clinical Pathology AND Transfusion Medicine	2	2
UGMLTDSEC503 A and 503B		Histopathology/Cytology AND Parasitology	2	2

- We have designed special practical for this module to enhance allied healthcare professional skills of the learner

T.Y.Bsc. Medical Lab Technology

Semester 6

Paper 1 [UGMLTC-601]: VIROLOGY, MYCOLOGY				
Course Code	**Unit**	**Topics**	**Credits**	**L/week**
UGMLTDSE - 601	I	Introduction to Virology & Mycology	4	4
	II	Clinical virology & viral pathogenesis		
	III	Clinical mycology & fungal pathogenesis		
Paper 2: [UGMLTC602]: MOLECULAR BIOLOGY				
UGMLTDSE - 602	I	Structure, Function and Replication of DNA and importance of proteins in molecular biology	4	4
	II	Gene expression		
	III	Molecular basis of mutation & Recombinant DNA Technology		
Paper 3: [UGMLT DSEC -603A**]:** QUALITY MANAGEMENT & NABL ACCREDITION				
UGMLTDSE - 603A	I	Overview of the quality management system: Facilities and safety, overview: Equipment management	4	4
	II	Process Quality Control: Purchasing and Inventory: Sample management, Personnel management		
	II	Information management & Statistical Analysis, External quality assessment (EQA): Norms and Accreditation		
Paper 4 [UGMLT DSEC -603B**]:** Industry Automation				
UGMLT DSE-603B	I	What is automation, automation in clinical biochemistry laboratory	4	4
	II	Automation in Hematology laboratory & blood banking		
	III	Automation in Microbiology laboratory & Histopathology laboratory		
Semester 6 Practical				
UGMLTCP601-602		Virology & Mycology Molecular Biology	2 2	2 2
UGMLTDSECP-603 A AND 603B		Quality Management & NABL Accreditation Industry Automation		

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T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 5

Paper 1 [UGMLTC501]:		
Course Code	**Title**	**Credit**
UGMLTDSE 501	**ClinicalPathology**	4
Unit I	Urine Examination & Stool Examination • Urine formation • Types of Kidney diseases (pyelonephritis, glomerulonephritis, nephrotic syndrome, etc) • Physical, chemical, microscopic examination of Urine • Chemical analysis of renal calculi • Clinical significance of stool examination • Physical, chemical examination of stool • Microscopic examination of Stool (saline, iodine, methylene blue wet mounts)	
Unit II	**Sputum & Seminal fluid Examination** • Anatomy of respiratory system, composition of sputum • Diseases of respiratory system (TB, bronchitis, pneumonia, etc) • Physical & microscopic examination of sputum (wet mount, Leishman staining, Gram's staining, AFB) • Anatomy of male reproductive system, clinical significance of seminal fluid examination • Process of spermatogenesis • Physical, chemical examination of seminal fluid • Microscopic examination of Seminal fluid (sperm count, sperm motility, sperm morphology)	
Unit III	**Cavity fluid Examination** **Study of transudates & exudates** • Collection of various cavity fluids (thoracentesis, pericardiocentesis, paracentesis) • Clinical significance of cavity fluid examination • Physical, chemical, microscopic examination of • CSF (Cerebro spinal fluid) • Peritoneal fluid • Pericardial fluid • Pleural fluid • Synovial fluid	

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T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 5

Paper 2: [UGMLTC502]:		
Course Code	**Title**	**Credit**
UGMLTDSE 502	**Transfusion medicine**	4
Unit I	**Immunohematology introduction,** • Blood banking concepts (history of transfusion medicine) • FDA rules & regulations (physical facility, location, different sections of blood bank, space requirements, equipment, personnel, documentation, etc) • Red cell antigen-antibody • ABO, Rh blood grouping, genotype & phenotype • ABO & Rh typing, cell & serum grouping (different methods, slide, tube, microplate, gel technology. etc) • Bombay blood group • Du variant	
Unit II	**Compatibility test, Cross matching** • Major & minor cross matching • Antibody titer test, antibody screening test • Different tests conducted in Blood bank (TTI testing lab) • Direct Coomb's test, • Indirect Coomb's test • Investigations of Hemolytic Disease of New born • Different types of blood bags (with different anticoagulants, CPDA, ADSOL, SAGM, etc)	
Unit III	**Blood banking techniques** • Blood donor selection (types of donors, screening of donors, etc) • Bleeding technique • Preservation of blood bags • Apharesis • Blood component preparation & storage (blood centrifugation, separation of components, packed RBC, leucocyte depleted RBC, fresh frozen plasma, platelets, etc) • Lab Investigations of blood transfusion reactions	

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T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 5

Paper 3: [UGMLTC503]:		
Course Code	**Title**	**Credit**
UGMLTDSE -503 A	**Histopathology & cytology**	4
Unit I	**Introduction & orientation to Histopathology and cytological techniques** • Cell division • Methods of examination of tissues & cells (types of tissues & cells) • Sample accessioning & grossing (criteria for rejection of samples) • Basic steps in tissue processing, requirements & procedure (fixation, decalcification, dehydration, clearing, impregnation of tissue) • Tissue processing (manual method & using automatic tissue processor)	
Unit II	**Preparation of tissue section for microscopy** • Tissue embedding (block making using paraffin wax-by manual method & using tissue embedding system) • Sectioning (different types of microtomes-rotary, rocking, base sledge, etc.) • Slide adhesives • Theory of staining (classification of dyes, dye structure, • Routine H & E staining- progressive & regressive staining (preparation of stains-Hematoxylin, eosin, acid alcohol) • Types of staining procedures (manual, rapid staining, using automatic stainer, re-staining, trouble shooting) • Frozen sections (using cryostat, rapid staining) • Special stainings (acid fast staining, Fite Farraco, Giemsa staining, Congo red, Orcein, etc)	
Unit III	**Cytology, IHC** • Types of cytology specimens collections (exfoliative cytology, Fine Needle Aspiration Cytology – FNAC, Body fluids) • Types of cytology specimens (cervical smear-PAP smear, vaginal smear, endometrial aspiration smear, sputum cytology, bronchoscopic specimens, nipple discharge, specimen from nasopharynx, larynx, etc) • Sampling devises (Ayre's spatula, cervix brush, Endo-cervical brush, cyto brush, etc) • Requirements of FNAC (needles, syringes, slides, etc.) • Body fluid cytology (urine, CSF, pericardial fluid, peritoneal fluid, etc)	

	• Cytology fixatives (95% ethyl alcohol, ether/alcohol mixture, 100% methanol, isopropanol, etc) • Staining method (Pap's staining-fixation, nuclear staining, cytoplasmic staining-OG-6. EA-36, etc) • Immuno Histo Chemistry-IHC (antigen-antibody reactions, labelling methods, direct, indirect, avidin-biotin method, standard IHC protocol) • Museum techniques (Reception, Preparation, Fixation, Restoration, Preservation, Presentation of histopathology specimens)	

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T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 5

Paper 4 [UGMLTGE501]:		
Course Code	**Title**	**Credit**
UGMLTDSE -503 B	**Parasitology**	
Unit I	**Introduction to human Parasitology** • Terms used in parasitology (Mutualism, host, parasite, Symbiosis, Commensalism, Definitive host, intermediate host, etc) • Mode of transmission of parasitic infection (direct & indirect mode of transmission) • Host parasite relationship • General life cycle of parasites • Classification of Parasites (Ectoparasites, endoparasite, obligate, facultative, etc) • Types of specimen used for parasitological examination (stool, blood, urine, sputum, etc)	
Unit II	**Medical Protozoology** • Class- Rhizopoda (Free living pathogenic amoebae, E. histolytica, E. coli, E. gingivalis, E. nana, etc) • Class – Zoomastigophora (The Oro-intestinal and Urogenital flagellates, Haemo-Somatic Flagellates, Chilomastix mesnili, Giardia lamblia, Trichomonas hominis, etc) • Class -Telosporidia (Intestinal and tissue Coccidian Parasite, Haemosporidia, Isospora bell, Toxoplasma gondii, Malarial parasite) • Class -Ciliatea (Ciliates, Leishmania, Trypanosoma gambiense, B. coli)	
Unit III	**Medical Helminthology** • Platyhelminths (Class cestoda (tapeworm), Taenia saginata, Hymenolepis nana, Echinococcus granulosus, Diphyllobothrium latum, etc) • Class trematodes(flukes) : (Blood Flukes, Schistosoms, Liver Flukes, Fasciola giagantica , Intestinal Flukes, Fasciolopsis buski) • Helminths, Class Nematoda (Intestinal nematodes, Tissue nematodes, round worm, pin worm, hook worm, whip worm, Wucheraria bancrofti, loa loa)	

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T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 5 Practical

Course code	Title	Credit
UGMLTDSE -501	**Clinical Pathology**	2
	• Physical examination of urine (volume, colour, appearance, specific gravity, deposit, etc) • Chemical examination of urine(manual methods for proteins, sugar, ketone bodies, occult blood, bile salts/bile pigments, urobilinogen, etc) • Microscopic examination of Urine (epithelial cells, RBC, pus cells, casts, crystals, etc) • Physical examination of stool (colour, form & consistency, mucus, blood etc) • Chemical examination of stool (presence of bile, occult blood, pH, etc) • Microscopic examination of stool (epithelial cells, RBC, pus cells, presence of ova & cysts of parasites) • Physical examination of sputum (volume, colour, consistency, frank blood, etc) • microscopic examination of sputum (pus cells, RBC, cheesy masses, bronchial casts, sulfer granules, presence of Gram positive & Gram negative bacteria) • Physical examination of seminal fluid (volume, colour, appearance, consistency, liquefaction time) • Chemical examination of seminal fluid (test for fructose) • Microscopic examination of seminal fluid (sperm count using Neubauer chamber, motility and morphology of sperms by H & E staining) • Physical examination of CSF, peritoneal, pericardial, pleural & synovial fluid (volume, colour, appearance, specific gravity) • Chemical examination of cavity fluids (tests for proteins, sugar, etc) • Microscopic examination of cavity fluids (pus cells, RBC, presence of bacteria, etc)	
UGMLTDSE - 502	**TRANSFUSION MEDICINE**	2
	• Preparation of Normal saline, Preparation of pooled Red Cells • Manual – ABO Blood Grouping (cell grouping & serum grouping) • Rh Blood Typing • Manual – ABO Blood Grouping (by slide method & tube method)	

	• Test for weak D or D variant (Du) • Coomb's Test or Antiglobulin Test (Direct & Indirect test) • Compatibility testing or Cross matching (major & minor cross matching using saline, Coomb's serum (AHG) & bovine albumin) • Investigation of Transfusion reaction	
UGMLTDSE - 503 A	**Histopathology & cytology**	2
	• Sample accessioning and Grossing • Fixation, decalcification • Tissue processing • Embedding • Preparation of Tissue Section for Microscopy (sectioning, picking up tissue section from water bath, putting it on slides) • Routine H & E staining • Cytological techniques & staining methods • Immuno Histo chemistry (IHC) • Special stainings (Acid fast staining, Giemsa staining, PAP staining, PAS staining, etc)	
UGMLTDSE 503 B	**Parasitology**	2
	• Stool examination (Macroscopic examination for presence of worms, microscopic examination for presence of cysts & ova, using saline, iodine & methylene blue mounting media, concentration methods) • Urine examination (wet mount preparation of urine sediment) • Vaginal and Urethral Discharge (direct examination) • Blood specimen (preparation of thick & thin smears for detection of malarial parasite, wet blood film for microfilaria, spleen aspirate smears for Lieshmania species • Scotch tape method for recovery of pin worm ova, • Preservation of stool specimens (formalin, Merthiolate iodine formalin-MIF, Polyvinyl alcohol-PVA)	

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T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 6

Paper 1 [UGMLTC601]:		
Course Code	**Title**	**Credit**
UGMLTDSE 601	**VIROLOGY & MYCOLOGY**	4
Unit I	**Introduction to Virology & Mycology** • Historical perspectives of virology • Characteristics of viruses, virus classification • Viral structure, morphology & genome • Viral proteins & enzymes • Historical perspectives of Mycology • Characteristics of fungi, classification of fungi (based on morphology, physiology & genetics) • Taxonomic categories of medically important fungi, fungal nomenclature & identification • Morphological features of fungi (yeasts, molds, dimorphic fungi)	
Unit II	**Clinical virology & viral pathogenesis** • Host – virus interactions • Immune response to viral infections • Common viral pathogens & associated diseases • Epidemiology of viral infections • Laboratory diagnosis of viral infections • Specimen collection & handling • Viral culture techniques • Molecular diagnostic methods (PCR, RT-PCR) • Serological assays (ELISA, neutralization assay)	
Unit III	**Clinical mycology & fungal pathogenesis** • Fungal life cycle (asexual & sexual reproduction) • Mechanism of fungal pathogenesis, host-fungus interactions • Common fungal pathogens & associated diseases • Epidemiology & risk factors for fungal infections • Laboratory diagnosis of fungal infections • Specimen collection & processing • Direct microscopic examination (KOH mount, calcofluor white stain) • Culture techniques (sabouraud agar, selective media) • Molecular diagnostic methods (PCR, Sequencing)	

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T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 6

Paper 2: [UGMLTC602]:		
Course Code	**Title**	**Credit**
UGMLTDSE 602	**Molecular Biology**	4
Unit I	**Structure, Function and Replication of DNA and importance of proteins in molecular biology** • DNA as the heritable material • Structure of DNA • DNA replication: semi-conservative replication, DNA polymerases, events at the replication form, replication of the lagging strand, telomeres, consequences of defects in telomerase. • Replication of genomes: origins of replication, control of DNA replication. • Structure of chromosomes: DNA packaging, features of metaphase chromosomes. • Amino acids: structure of twenty amino acids, classification, titration curve of amino acids, concept of zwitter ionic structure, physical and chemical properties. • Proteins: classification of proteins on the basis of composition, conformation and function, different level of structural organization of proteins (primary, secondary, tertiary & quaternary), forces stabilizing protein structure and shape, physical and chemical properties.	
Unit II	**Gene expression** • From DNA to RNA: (the structure and function of the gene, promoters and terminators. Transcriptional initiation, elongation and termination, RNA polymerases) • Structure, function and Biochemical properties of RNA • From RNA to Protein: the genetic code, codons & anticodons, the ribosome & translation • Gene expression in Prokaryotes: The Lac operon • Gene expression in Eukaryotes: regulation of transcription, promoters, enhancer elements; RNA splicing and modifications, Trp operon	
Unit III	Molecular basis of mutation & Recombinant DNA Technology • Consequences of mutation: genotype versus phenotype, molecular basis of dominant and recessive alleles, somatic versus germline mutations. • Gene mutations: missense versus nonsense mutations,	

	insertions, deletions and frameshifts. Genetic reversion and suppression, mutants and types. • Chromosomal mutations: changes in chromosome number or structure. • Occurrence of mutations: spontaneous mutations and effects of environmental factors • Principles of Genetic Engineering: gene cloning and genomics. • PCR techniques and modifications • DNA Fingerprinting • Restriction enzymes • Transformation in prokaryotes	

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T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 6

Paper 3: [UGMLTC603 A]:		
Course Code	**Title**	**Credit**
UGMLTDSE -603 A	**QUALITY MANAGEMENT & NABL ACCREDITION**	4
Unit I	**Overview of the quality management system: Facilities and safety overview: Equipment management** • Importance & definition of quality management system • History of LQM, International Laboratory Standards Importance of safety • Laboratory design, Geographic or spatial organization • Safety management program, Identification of risks • Emergency management and first aid • Selecting and acquiring equipment • Implementing an equipment maintenance program • Equipment maintenance and documentation	
Unit II	**Process Quality Control: Purchasing and Inventory: Sample management, Personnel management** • Implementing a purchase and inventory management program • Receipt and storage of supplies • The laboratory handbook, collection and preservation • Sample processing, Sample storage, retention and disposal; Sample transport • QC for varying methods, • Control materials; Establishing the value range for the control material; Graphical representation of control ranges • Control materials; Establishing the value range for the control material • Recruitment and orientation of trained personnel • Training and continuing education; Employee performance appraisal • Customer satisfaction surveys, Assessing and monitoring customer satisfaction	
Unit III	**Information management & Statistical Analysis, External quality assessment (EQA): Norms and Accreditation** • Documents and Records • The quality manual, Standard operating procedures (SOP) • Document control; Overview of records; Storing documents and records • Computerized laboratory information systems,	

	• Westgard rules – 12S, 22S,13S,R4S,10X Rules; Mean, Standard Deviation, Coefficient of variation, Standard deviation Index • External audit; Internal audit • Proficiency testing; Other EQA methods; Comparison of EQA methods • International standards and standardization bodies, National Standards and technical guidelines; • Certification and accreditation; Process of accreditation; Benefits of accreditation, ISO, NABL, NABH, CAP, etc	

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Semester 6

Paper 4 [UGMLT-GE603 B]:		
Course Code	**Title**	**Credit**
UGMLTDSE 603 B	**Industry Automation**	4
Unit I	**What is automation, automation in clinical biochemistry laboratory** • History of automation • need for automation • Types of automation (total laboratory automation, TLA, system based automation) • Automation in 3 phases (pre-analytic, analytic, post-analytic) • Automation in Pre-analytical phase • To study principle & working of Automation in analytical phase (continuous flow, discrete, centrifugal, random access, batch analyser, modular analysers, etc. • Dry chemistry analysers • Automation in post-analytic phase	
Unit II	**Automation in Hematology laboratory & blood banking** • History of automation in hematology cell counting (by Coulter) • Principles used in hematology automation (impedance, optical light scattering, VCS technology) • 3 part analyzers (neutrophils, lymphocytes, granulocytes along-with monocytes) • 5 part analyzers (individual WBC counted) • 7 part analyzers (most advanced) • Automation in BLOOD BANK (blood component separation by Apharesis) • RBC washing for IgA deficient patients • ABO typing, antibody screening, ABO titers, selected cell panels and compatibility testing in pretransfusion (immunohematology) testing • Product safety and detection of growth of microorganisms in platelets through culture: BacT / ALERT	
Unit III	**Automation in Microbiology laboratory & Histopathology laboratory** • Specimen processing • Incubation & monitoring the culture plates • Plate reading, organism identification & antibiotic sensitivity • Special sample types (ABCS-Automated Blood Culture System, • Principles of Bactec, BactAlert, VersaTrek instruments	

	• Rapid identification using API 20 E system., VITEK instruments • Use of Artificial Intelligence would replace manual steps in analysing samples with less TAT, Turn around time • Use of Automatic tissue processor • Slide stainer to do routine H & E staining • Automated labellers • Automation in tissue embedding	

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T.Y.Bsc. Medical Lab Technology
Choice Based Credit
Semester 6 Practical

Course code	Title	Credit
UGMLTDSE -601	**Virology & Mycology**	2
	• Specimen collection from fungal infections. • Direct microscopic examination using different mounting media, e.g. KOH, lactophenol blue, calcofluor white stain • Specimen to be inoculated on potato dextrose agar, sabouraud agar. • Fungi can be identified by colony characteristics, morphology of hyphae, spores etc. • Laboratory demonstrations/videos to be presented regarding ➢ Specimen collection for viral infections ➢ Viral inoculation & growth in animals, embryonated eggs, tissue culture.	
UGMLTDSE - 602	**Molecular Biology**	2
	Molecular biology experiments would be explained & demonstrated using videos as follows: • DNA Extraction. • Conventional PCR. • Agarose Gel Electrophoresis. • DNA Sequencing. • cDNA Synthesis. • Bacterial Plating out Technique (Streak Plate Method) • DNA Fingerprinting Using Gel Electrophoresis. • Oxidase Test. • PCR & RT-PCR techniques	
UGMLTDSE - 603 A	**QUALITY MANAGEMENT & NABL ACCREDITION**	2
	• Biosafety Management • Sample Management • Calculation of Mean and Standard Deviation, Levey-Jennings Charts • Scenario — Purchasing and Inventory • EQA and Processing Proficiency Testing Samples	

	• Scenario — Preparations Needed for a Laboratory Accreditation • Differentiating Documents from Records and The Quality Manual • Scenario — Overview of Personnel • Planning a Customer Satisfaction Survey • Differentiating Documents from Records and The Quality Manual	
UGMLTDSE 603 B	**Industry Automation**	2
	• Industry automation would be observed & working would be understood during OBSERVERSHIP/INTERNSHIP • Phlebotomy room, collection room • In hematology lab • Microbiology lab • Clinical biochemistry lab • Blood bank • Histopathology lab	

- We have designed special practical for this module to enhance allied healthcare professional skills of the learner

References:

1. iTransform Handbook on Anatomy, Physiology
2. iTransform Handbook on Foundation Program
3. iTransform Handbook on Medical Terminologies
4. iTransform Handbook on Phlebotomy
5. MEDICAL LABORATORY TECHNOLOGY, Vol. 1,2,3, Chief editor: Kanai Mukherjee CBS Publication
6. TEXT BOOK of MEDICAL LABORATORY TECHNOLOGY, by Mrinalini Sant CBS PUBLICATION
7. EXTBOOK of MEDICAL LABORATORY TECHNOLOGY, by P.B. GODKAR,DARSHAN GODKAR, vol. 1,2 BHALANI Publication.
8. MEDICAL LABORATORY TECHNOLOGY, Methods & Interpretation, by Ramnik Sood, Jaypee Publication
9. HISTOLOGICAL TECHNIQUES, A Practical Manual By K. Laxminarayan, BHALANI Publication

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