Arts, Science and Commerce College CIDCO, Nashik-422 008

Affiliated to Savitribai Phule Pune University, Pune

SYLLABUS

FOR

Diploma in Medical Laboratory Technology (I Year)

Under Scheme of

UGC Sponsored Skill based Courses under NSQF

[Effective from 2020-21]

Preamble

The Government of India to meet the goal of empowering the youth and also to make education relevant and creating 'industry fit' skilled work force, initiated the skill based programs. Based upon the guidelines for B. Voc. courses issued by AICTE, UGC and also the guidelines of B. Voc. programs in colleges in NSQF (Academic council sub-committee report of SPPU, June 2019) the Board of studies has prepared the admission rules, regulations and syllabus structure common for the programs.

Program Outcomes

Vocational Education is education that prepares the students for specific job role in Healthcare sector. It trains the students from a trade, technician or professional position in Research and Development organizations for specific job roles.

The program outcomes are the skills and knowledge which the students acquire at each exit level and at the end of graduation. These outcomes are generic and are common to all exit levels mentioned in the program structure.

- Students with vocational training can find work in several state and central government organizations, non-profit groups, and academic institutions and in private sectors as well.
- This program prepares students for specific types of occupations and for direct entry into the market.
- After completion of this program students will have enough competences, to get benefit from market opportunities.
- This program would enable students to update their knowledge and professional skills for entering the work force, executing income generating activities or occupying better positions.

After completion of this program (Medical Laboratory Technologists), students can hold supervisory or management positions in laboratories and hospitals. They can also work as Laboratory manager/Consultant/supervisor, health care Administrator, Hospital Outreach coordination, laboratory information system Analyst/Consultant, educational consultant / coordinator etc. Additional opportunities are available in molecular diagnostics, molecular biotechnology companies and in vitro fertilization laboratories as well as in research labs.

Eligibility for admission:

i. Type A - Students who have already acquired NSQF certification level 4 in a particular trade and opted

ii. Type B - Students who have passed 10+2 or equivalent in any stream from any recognized board or university without any background of vocational training.

iii. Type C – Students passed 10+2 examination with conventional schooling without any background of vocational training.

While admitting type B and type C students' additional courses for skill intensive training and teaching during the first six months shall be mandatory for such students, who will be assessed and certified for NSQF level 4 of skill competency by concerned CSA at the end of first semester. However, students belonging to type A will not require such certification as they were already having NSQF level 4 certificates in same industry sector / job role required for specified skill credits. All students continuing to Diploma courses or further will be treated at par from second semester onwards. Student may exit after diploma or advanced diploma level courses or above. The academic progression for students in vocational stream after senior secondary level should be as per table 1 and thus the curriculum shall be framed as per these guidelines.

Table 1: NSQF Level and Credits

NSQF Level	Skill compone credits	General Education Credits	Total credits for Award	Normal duration	Exit points / Awards
5	36	24	60	Two semesters	Diploma

Evaluation method

a. **Theory Courses** –

i. The assessment of theory subjects shall include continuous internal assessment [CIA] of 50% of total marks which can include midterm test, short quiz, assignment, extension work, project work, seminar, presentations etc. There shall be semester end examination [SEE] of 50% of the total marks.

ii. The student should get minimum 30% marks in CIA and SEE each and minimum 40% in CIA and SEE jointly.

iii. In case of failure in CIA the student shall appear only in the next academic year when the said course is offered in the regular academic session at his/her responsibility. However, in case of failure in SEE in particular course(s) exam will be conducted in immediate subsequent semester.

iv. In case a student fails in certain course(S) in a particular semester and the same course(s) are modified / revised/removed from the curriculum in due course, the student will have to appear as per the newly framed curriculum and/or pattern in subsequent semester at his/her own responsibility.

b. **Practical Courses-**

i. The skill component of the course will be assessed and certified by the respective Certified Skill Assessor. The Certified skill assessor for a specific trade is made available by the respective sector skill council or a committee headed by the respective board or prescribed by the concerned regulatory body. Assessment of practical courses / on job training course shall be in equal proportion by the internal and external examiners.

ii. The semester end exam for practical courses shall be conducted at the end of each semester along with the theory exams.

iii. A student must get minimum 40% marks (jointly in internal and external) to pass in the practical courses.

1. **Grading System**

Table 2: Letter Grades, Points and Marks

Letter Grade	**Points**	**Marks obtained**
O: Outstanding	10	80-100
A+: Excellent	9	70-79
A: Very Good	8	60-69
B+: Good	7	55-59
B: Above Average	6	50-54
C: Average	5	45-49
P: Pass	4	40-44
F: Fail	0	0-39
Ab: Absent	0	-

Table 3: Grade point Average

Grade Point Average	Grade
9.00 – 10.00	O
8.50 – 8.99	A+
7.50 – 8.49	A
6.50 – 7.49	B+
5.50 – 6.49	B
4.25 – 5.49	C
4.00 – 4.24	P
0.00 – 3.99	F

2. **Computation of SGPA and CGPA**

- The semester end grade sheet will contain grades for the course along with titles and SGPA. Final grade sheet and transcript shall contain CGPA.
- SGPA: The performance of a student in a semester is indicated by a number called the semester grade point average (SGPA). The SGPA is the weighted average of grade points obtained in all the courses registered by the student during the semester.

Semester Grade Point Average (SGPA) =

$$\text{SGPA} = \frac{\sum_{i=1}^{p} CiGi}{\sum_{i=1}^{p} Ci}$$

$$= \frac{\sum \text{Grade Points earned} \times \text{Credits for each course}}{\text{Total credits}}$$

SGPA is calculated up to two decimal places by rounding off.

- **CGPA**: The CGPA is the weighted average of the grade points obtained in all the courses (theory Practical courses) of all the semesters till the respective exit point. It is calculated in the same manner as the SGPA. It is calculated based upon the SGPA of the concerned semesters.

OTHER RULES- University may frame additional rules and regulations or modify these regulations if needed and once approved by the University they would be binding on the students.

3. **External students:** No external students are allowed for this course.
4. **Setting of Question paper/Pattern of question paper:** For theory courses, end semester question papers will be set as per the University instructions.

Table 4:Question Paper Pattern

Question 1 (20 Marks)	10 compulsory sub-questions, each of 2 marks; answerable in 2-3 lines
Question 2 (20 Marks)	4 out of 6 – short answer type questions of 5 marks each; answerable in 8– 10 lines
Question 3 (10 Marks)	2 out of 4 – Descriptive question based on theory.

5. Verification /Revaluation: There is also a provision for verification and revaluation. In case of verification, the existing rules will be applicable. The revaluation result will be adopted if there is a change of at least 10% marks and in the grade of the course. There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

I. Compulsory paper: All papers given in the syllabus are compulsory.

II. Optional paper: There will be no optional papers.

III. Question papers and paper:

Theory: Continuous Internal Assessment (CIA): 50 Marks

Semester end examination (SEE): 50 Marks

Practical: Continuous Internal Assessment (CIA): 75 Marks

Semester end examination (SEE): 75 Marks

IV. Medium of instruction: English

Course Code

An eight-character Course code is assigned to each course. The first two characters indicates the discipline, third and fourth character indicates the programme, fifth for year, sixth for semester, seventh characters for serial no of the course, eighth for general or skilled component.

Example:

DMLTG111

DMLT: Diploma in Medical Laboratory Technology

G/S: General Component (G) / Skill Component (S)

1: First semester

1: First year

1: Serial number of the course

Course structure of Community College Course
Diploma in Medical Laboratory Technology
One Year course (Semester I & II)

Semester	Course no	Papers/Courses	Credit
I	**Semester I**		
		General Education Components	
	DMLTG111	Basics of Anatomy, physiology and laboratory procedures	04
	DMLTG112	Haematology and Blood Banking	04
	DMLTG113	Basics of Computer and Communication skill	04
		Skill Development Components	
	DMLTS111	Basics of Anatomy, physiology and laboratory procedures	06
	DMLTS112	Haematology and Blood Banking	06
	DMLTS113	Basics of Computer and Communication skill	06
	Total credits for Semester-I (General Education Component + Skill Development component)		**30**
II	**Semester II**		
		General Education Components	
	DMLTG211	Microbiology	04
	DMLTG212	Clinical Pathology and biochemistry	04
	DMLTG213	Histopathology	04
		Skill Development Components	
	DMLTS211	Microbiology	06
	DMLTS212	Clinical Pathology and biochemistry	06
	DMLTS213	Histopathology	06
	Total credits for Semester-II (General Education Component + Skill Development Component		**30**

DMLTG111: Basics of Anatomy, physiology and laboratory procedures (General)

Total credits: 4 **Teaching Hours-60 (4 hours/week)**

Aim of the course: The purpose of the Human Anatomy and physiology is the acquisition by students of scientific knowledge about the structure and function of the human body. To understand basic pathological laboratory procedures.

Outcome of the course: Students will understand body parts organs system, size, shape and relation with other organs. Location of important organs and system.

Syllabus

Unit I **Hours- 10**

Introduction to anatomy- Scope of Anatomy and Physiology – Definitions and Terms in Anatomy and Physiology, structure and function of human cell, Elementary tissues of human body.

Unit II **Hours- 15**

Cardio Vascular System- Structure and functions of various parts of the heart & Blood pressure.

Respiratory System -Structure & function of lungs, Physiology of breathing, Lung volume & capacity.

Digestive System- Study of various parts of digestive system (Buccal Cavity, tongue, tonsil, Pharynx, Oesophagus, Stomach, intestine etc).

Unit III **Hours- 15**

Urinary System- Structure and function of kidneys, its role in urine formation, ureter, urinary bladder.

Reproductive System -Anatomy & Physiology of Male & Female reproductive system, menstrual cycle.

Unit IV **Hours-15**

Nervous System- Elementary knowledge of structure – functions of nervous system – Brain, Spinal Cord & Nerves.

Endocrine System- Endocrine glands their hormones and functions – Thyroid, Parathyroid, suprarenal, Pituitary and Thymus.

Unit V **Hours-5**

Basic laboratory procedures- Responsibilities of laboratory workers, Laboratory safety, First aid, Selection, care and maintenance of glassware, Record keeping.

Reference Books:

1. Solon on E.A. (2008) Introduction to Human Anatomy and Physiology 3rd Ed. Saunders: St Louis.
2. Chaursia, B.D. & Garg, K., (2012) Human Anatomy Regional and Applied CBS Publications: New Delhi
3. T.S. Ranganathan – A text book of Human Anatomy
4. Fattana, Human anatomy (Description and applied) Saunder's & C. P. Prism Publishers, Bangalore – 1991
5. W. F. Ganong - Review of Medical Physiology
6. Praful B. Godkar- Textbook of medical laboratory technology .
7. Tortora, Principles of Anatomy and Physiology
8. Ross and Wilson ANATOMY and PHYSIOLOGY in Health and Illness Eleventh Edition Anne
9. Chakraborty. N, Fundamental of human anatomy
10. Anand, Mahindra Kumar, Anand`s Human Anatomy
11. Grindel, C.G. Anatomy and Physiology
12. S. Ramkrishnan, KN Sulochana Manual for Medical Laboratory Techniques.
13. Anatomy and Physiology Lab by Daniel McNabney and De Loris Hesse
14. https://www.researchgate.net/publication/319077173_The_laboratories_of_anatomy_and_the_standard_practices_therein.
15. https://courses.lumenlearning.com/ap1x94x1/
16. https://textbookequity.org/Textbooks/anatomy+phys+vol2a.pdf
17. https://www.researchgate.net/publication/344058244_FUNDAMENTAL_PRINCIPLES_OF_HUMAN_ANATOMY_PHYSIOLOGY

DMLTS111: Basics of Anatomy, physiology and laboratory procedures (Skill based)

Total credits: 6

Practicals:

1. Identification of axial bones.
2. Identification of appendicular bones.
3. Study of joints.
4. Understanding of electrocardiogram.
5. Determination of heart rate and pulse rate.
6. Recording of blood pressure.
7. Study of epithelial and connective tissue.
8. Study of muscular and nervous tissue
9. Study with charts and models of all organ systems mentioned above.
10. Recording of body temperature.
11. Study of laboratory safety instructions.
12. Study of laboratory first aid.
13. Standardization of volumetric pipette.
14. Cleaning of glassware
15. Sterilization of glassware
16. Preparation of anticoagulated bulbs.
17. Disposal of laboratory waste.

DMLTG112 : Hematology and Blood Banking (General)

Total credits: 4 **Teaching Hours-60(4 hours/week)**

Aim of the course:

The aim of hematology and blood banking is to understand role of blood and blood components. Student should acquire knowledge about blood transfusion and diagnosis of different blood disorders.

Outcome of the course:

Development of proficiency skill in hematology and blood banking techniques.

Syllabus

Unit I **Hours- 10**

Introduction to Haematology & Blood cells, Components of blood and their functions, Hematopoietic system. Introduction to anticoagulants

Unit II **Hours- 20**

Hemostatis- Mechanism of blood coagulation, Fibrinolysis, disorders of hemostasis, laboratory test for hemostasis function.

Cell separation, ESR, Packed cell volume (PCV), Red cell Indices - MCV, MCH, MCHC. Morphology of Normal and Abnormal blood cells.

Unit III **Hours- 10**

Immunology - Definition and Classification, Structure and function of immune system, Antigen, Antibodies, Antigen and antibody reaction and clinical importance.

Unit IV **Hours- 20**

Principles of immunohematology- clinical significance of blood transfusion, Selection of blood donors, Method of blood collection, Basic laboratory tests, Transportation of blood after collection, routine blood transfusion tests.

Storage of blood, Preparation of blood components, Auto transfusion, Placental blood transfusion (Intrauterine transfusion) Plasmapheresis, Transfusion reaction, Blood transfusion therapy.

Reference :

1. Praful B. Godkar- Textbook of medical laboratory technology.
2. Kanai L. Mukharjee- Medical laboratory technology- A procedure manual for routine diagnostics tests., vol-1
3. Immunology by Tizzard.
4. Immunology by kuby.
5. Essential hematology by Victor Hoffbrand, Paul A. H. Moss(Willey Black well)
6. Rodak's hematology by Elaine Keohane, Larry Smith, Jeanine Walenga.
7. Hematology, Immunology & Infectious disease by Robin K. Ohls, Akhil, Maheshwari.
8. Hematology at a glance by Atul B. Mehta, Victor Hoffbrand.
9. Mollison's Blood Transfusion in Clinical Medicine by Klein, Mollison's.
10. Essentials of Blood grouping & Clinical Application by K. P. Ranganathan.
11. Blood Bank Technology by Williams & Williams.
12. Immunohematology and Blood banking, Principles and Practice, by Ajmani**,** P.S.
13. Clinical pathology, heamatology and blood banking by Nanda Maheshwari.
14. Modern blood banking and Transfusion Practices 6th edition, By Denies M. Harmening.
15. https://www.jaypeedigital.com/book/9789386261182
16. https://www.researchgate.net/publication/323959789_Handbook_of_Blood_Banking_and_Transfusion_Medicine
17. https://www.jaypeebrothers.com/pgDetails.aspx?book_id=9789386261182

DMLTS112 : Hematology and Blood Banking (Skill based)

Total credits: 6

Practical:

1. Introduction to laboratory equipments.
2. Collection of blood , separation of plasma and serum
3. Hemoglobin estimation.
4. R.B.C. count.
5. Total leukocyte count
6. Differential leukocyte count
7. Detection of malarial parasite from PBS.
8. Platelet count
9. Bleeding time, clotting time, prothrombin time
10. Erythrocyte sedimentation rate.
11. Determination of red cell indices.
12. Determination of packed cell volume.
13. Determination of Blood group: ABO and Rh factor.
14. Cross matching of blood samples.
15. Direct & indirect Coomb's test- Principle involved & method used.
16. Rheumatoid arthritis test.
17. CRP test.
18. Demonstration of any one Nucleic acid testing
19. Demonstration of ELISA testing
20. Visit to Blood Bank

DMLTG113: Basics of Computer and Communication skill (General)

Total credits: 4 **Teaching Hours- 60(4 hours/week)**

Aim of the course: The aim of the subject is to bring out personality development with regard to the different behavioural dimensions that have far reaching significance in the direction of organizational effectiveness. To facilitate students to study basic IT skills using application software tools in industry and teaching –learning process.

Outcome of the course: Awareness in the participants with regard to the different aspects of interpersonal relations based on the ideas envisaged in Transactional Analysis and their relative significance in the context of the functional effectiveness of organizations. Students will have command on basic IT skills to use computer and internet facilities for their academic and holistic development purpose.

Syllabus

Unit-I: **15 Hours**

Self-Analysis and Motivation - SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem. Creativity- Out of box thinking, lateral thinking. Attitude- Factors influencing attitude, Challenges and lessons from attitude, etiquette. Motivation- Factors of motivation, Self-talk, Intrinsic & Extrinsic Motivators. Goal Setting- Wish List, Smart Goals, Blue print for success, Short Term, Long Term, Life Time Goals. Time Management- Value of time, Diagnosing, Weekly Planner to do list, Prioritizing work.

Unit-II: **15 Hours**

Leadership and Interpersonal Relations - Introduction to leadership, Leadership Power, Leadership Styles and Leadership in administration.

Introduction to Interpersonal Relations- Analysis of different ego states, Analysis of Transactions, Analysis of Strokes. Introduction to Stress- Causes of Stress, Impact Stress and Managing Stress. Conflict- Introduction to Conflict and Causes of Conflict.

Unit III: **25 Hours**

Operating system- MS Office- Definition & functions, Basic components of windows, types of icons, taskbar, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders. Control panel -adding and removing software and hardware, setting date and time, screen saver and appearance.

MS-Word - Documentation - Introduction to Office Automation, Creating & Editing Document, Formatting Document, Auto-text, Autocorrect, Spelling and Grammar Tool, Document Dictionary, Page Formatting, Bookmark, Advanced features of MS-Word-Mail Merge, Macros, Tables, File Management, Printing, Styles, linking and embedding object, Template.

MS-Excel- Introduction to MS-Excel, Creating & Editing Worksheet, Formatting and Essential Operations, Formulas and Functions, Charts, Advance features of MS-Excel-Pivot table & Pivot Chart, Linking and Consolidation. Database Management using Excel-Sorting, Filtering, Table, Validation, Goal Seek and Scenario.

MS-PowerPoint - Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art, Layering art Objects, Animations and Sounds and insertion, Inserting Animated Pictures.

Unit IV: **5 Hours**

Introduction to concept of Internet - Internet applications, www, Email, ftp, web browsers (Internet explorer, Google Chrome, Mozilla).

References:

1. Lall & Sharma – Personal Growth Training & Development (Excel Books)
2. Janakiraman- Training & Development (Biztantra)
3. Hurlock, Elizabeth B - Personality Development (Tata McGraw Hill, 1st Ed.)
4. Sahu R.K. - Training for Development (Excel Books, 1st Ed.)
5. Prof. Achhru Singh & Dr. Dharminder Singh Ubha, Personality Development and Soft Skills.
6. Petri, H.L. and Govern, J.M., 2013, Motivation: Theory, Research, and Applications, (sixth edition) Wadsworth Cengage Learning: Belmont CA.
7. Soft skills, Career Development Centre, Green Pearl Publications.
8. Carnegie Dale, How to win Friends and Influence People, New York: Simon & Schuster.
9. Thomas A Harris, I am ok, You are ok , New York-Harper and Row.
10. Daniel Coleman, Emotional Intelligence, Bantam Book.
11. Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers.
12. Russell A. Stultz, Learn Microsoft Office – BPB Publication
13. Microsoft Office – Complete Reference – BPB Publication
14. P.K. Sinha and P. Sinha, Foundations of Computing, First Edition, BPB.
15. Torben Lage Frandsen, Microsoft office word.
16. Chetan Srivastva, Fundamentals of Information Technology, Kalyani Publishers.
17. Turban Mclean and Wetbrete, Information Technology and Management, Second Edition, John Wiley & Sons.
18. Satish Jain, Information Technology, BPB.
19. V. Rajaraman, Fundamental of Computers – (Prentice Hall)
20. P. K. Sinha, Fundamental of Computers – (B.P.B publication)
21. Alexis Leon, Introduction to Information Systems.
22. Dr. S. Chand, Courter, G Marquis, Microsoft Office 2000, Computer Fundamentals & Its Business Applications, Professional Edition. BPB.

DMLTS113: Personality Development and Computer Fundamentals (Skill based)

Total credits: 6

1. Stress, Anger and Time Management.
2. Communication Skills.
3. CV Writing and Interview Techniques.
4. Teamwork and Leadership.
5. Problem Solving and Conflict Resolution.
6. Presentation Skills.
7. Internet surfing.
8. MS-Windows: features.
9. Documentation Using MS-Word.
10. Electronic Spread Sheet using MS-Excel.
11. Database Management using Excel.
12. Presentation using MS-PowerPoint
13. Creating tables in MS ACCESS using different ways.
14. Import and export data from MS ACCESS.
15. Creating queries in MS ACCESS
16. Creating forms in MS ACCESS
17. Working of Internet with Different Browsers (Internet Explorer, Google Chrome, Mozzila).
18. Applications of Internet. (Handling Email accounts.
19. Student Have to Do Following Activities:
    i. How to create Email
    ii. How to send email?
    iii. How to Download the Data?
    iv. How to attach files with email?

DMLTG211: Microbiology (General)

Total credits: 4 **Teaching Hours-60(4 hours/week)**

Aim of the course: The aim of the subject is to understand basic microbiology and Immunology. The aim of the course is to introduce basic principles and application relevance of clinical disease. It covers study of bacteria, viruses and other pathogens related with infectious diseases in humans. The course will provide the conceptual basis for understanding pathogenic microorganisms.

Outcome of the course: Development of proficiency skill in demonstrating practical, use of tools, technologies and methods common to microbiology and Immunology.

Syllabus

Unit-I : **Hours:10**

General characteristics of- Bacteria, fungi, Virus, protozoa, staining technique**:** Monochrome staining, Gram's Stain, Acid fast staining, fungal staining, Spore and capsule staining.

Cultivation of Micro-organism **:**Introduction and uses of culture, Classification of culture media, Composition of common of Laboratory culture media, Special media and preparations, Techniques of inculcation and isolation, Antimicrobial sensitivity, Anaerobic cultivation techniques

Unit- II : **Hours: 20**

Study of bacterial pathogens:

i. Enteric pathogens (*E. coli, Shigella, Salmonella, Vibrio*)
ii. *Pneumococci* and *Neiserria*
iii. Pyogenic organisms – *Staphylococcus, Streptococcus, Pseudomonas*
iv. Spirochetes – *Treponema,*
v. *Clostridium tetani* and *Clostridium perfringens*
vi. *Mycobacterium tuberculosis* and *Mycobacterium leprae*

Unit- III: **Hours: 10**

Study of viral pathogens:

i. HIV

ii. Polio virus

iii. Hemorrhagic viruses (Dengue)

iv. Hepatitis A and Hepatitis B viruses

v. Influenza virus (human, swine, bird,SARS-Covid)

viii. Rota virus

ix. Rhabdoviruses (Rabies)

x. Herpes Virus (simplex, zoster)

Unit- IV: **Hours: 10**

Study of Protozoa and fungal pathogens:

i. *Plasmodium*

ii. *Entamoeba*

iii. *Giardia*

Study of Protozoa and fungal pathogens:

Candida and Non-Candida fungal pathogens.

UNIT V: **Hours: 10**

Chemotherapy: Introduction to chemotherapy, Selective toxicity, MIC, MBC, routes of drug administration

References:

1. Stanier, R. Y. (1987), General Microbiology, 5th Edition, Macmillan Pub. Co. NY
2. Powar and Daginawala, General Microbiology Vol.I and II, 1st Edition, Himalaya Publishing House, Mumbai16. Genetics -Analysis and Principles,Robert J Brooker, Benjamin-Cummings Pub Co;
3. Dey, N.C and Dey, TK. 1988, Medical Bacteriology, Allied Agency, Calcutta, 17thEdition
4. Ananthnarayana, R. and C.E, Jayaram Panikar, 1996 Textbook of microbiology, 5thedition, Orient Longman.
5. Rajesh Bhatia, Bacteriology
6. Sherris, John C, Ed, Medical Microbiology: an Introduction to infectious diseases.Elsevier Publication IInd edition.
7. Davis B.D., Delbacco, 1990 Microbiology 4th edition, J.B. Lippincott Co. NY
8. Chatterjee, Parasitology
9. Jayaram and Panicker, Parasitology
10. Scott, Hand book of laboratory technology
11. C.M.C. Vellore, Hand book of laboratory technology,
12. Kuby, Immunology , 6th edition.
13. Kanai L. Mukharjee- Medical laboratory technology- A procedure manual for routine diagnostics tests., vol-2
14. Brock Biology of Microorganisms, 14th Edition

20.Clinical **Microbiology** Made Ridiculously **Simple**, 6th Edition.

21.Prescott's **Microbiology**, 10th Edition.

22.Jawetz Melnick & Adelbergs Medical **Microbiology**, 27th Edition.

23.Bailey & Scott's Diagnostic **Microbiology**, 14th Edition.

DMLTS211: Microbiology (Skill based)

Total credits: 6

List of Practicals:

1. Microscopy – types of microscopes, focusing, care & handling of microscopes.
2. Preparation of laboratory media, plates and slants.
3. Collection of specimen by swab.
4. Monochrome staining of bacteria.
5. Gram staining of bacteria.
6. Acid fast staining
7. Fungal staining
8. Spore staining
9. Capsule staining.
10. Pour plate technique
11. Spread plate technique
12. Streak plate technique
13. Observation of motility
14. Identification of pathogen from urine.
15. Identification of pathogen from stool.
16. Identification of pathogen from pus.
17. VDRL test
18. Widal test
19. Pregnancy test
20. Visit to Microbiology laboratory.

DMLTG212: Clinical Pathology and Biochemistry (General)

Total credits: 4 **Teaching Hours-60(4 hours/week)**

Aim of the course: To understand structure, composition and biochemical reactions in body and to study the fundamental chemical principles that governs complex biological systems. To train students in Laboratory analysis of bodily fluids, such as blood, urine etc.

Outcome of the course: Development of proficiency in use of tools, technologies and methods used in clinical pathology and biochemistry.

Syllabus

Unit-I : **Hours: 05**

Preparation of laboratory solutions (Distilled water, Buffers, Normal, Molar, Percent solutions)

Unit -II: **Hours: 20**

Metabolism of carbohydrate, Lipids, Proteins. Role of Enzymes and hormones of the body. (Definition, function, properties, diagnostic importance)

Unit III: **Hours: 20**

Collection, Transport and Examination of specimens

Urine : Method of collection, normal constituents, physical examination, chemical examination and microscopic examination.

Stool Examination: Method of collection, normal constituents and appearance, abnormal constituents (Ova, Cyst), C.S.F. examination, physical examination, chemical examination, Microscopy.

Semen Analysis: Collection, Examination.

Examination of CSF- Collection and routine examination.

Examination of Sputum-Routine examination.

Unit IV: **Hours: 15**

Principles of Analytic Techniques - photometry, pH meter, Immuno – chemistry (Chromatography, Electrophoresis, NAT)

Automation in clinical biochemistry- Principle, types, uses of autoanalyser, Blood gas analyzer.

References:

1. Ziwa J.F.P Peter, Mayne P.D. Clinical Chemistry in Diagnosis and Treatment.
2. W.H. Heinemann -Practical Clinical Biochemistry – Verley Publications
3. William & Wilson, Edward Arnold A Biologist Guide to principle & Techniques of Practical Biochemistry
4. Rephale D.B,W.B Saunders - Lynch Medical Laboratory Technology
5. Plummer-Practical Biochemistry
6. Ramkrishanan, Prasman & Rajan -Text Book of Biochemistry
7. A.C Deb -Medical Biochemistry
8. Praful B. Godkar- Textbook of medical laboratory technology.
9. Kanai L. Mukharjee- Medical laboratory technology- A procedure manual for routine diagnostics tests., vol-2.
10. M. R. Chaudhari, Y. A. Kulkarni, S. B. Gokhale Biochemistry and Clinical Pathology
11. Milind J. Umekar , N. R. Kotagale , R. T. Lohiya A Text Book Of Biochemistry & Clinical Pathology
12. K. K. Pillai Biochemistry and Clinical Pathology, CBS Publishers & Distributors
13. https://okknf.smcebi.edu.pl/h5rzya2mo7nc/29-darren-grady-1/9788185790466-practical-biochemistry-amp-clinical-pathology-S301h0DjJ.pdf
14. https://books.google.co.in/books?hl=en&lr=&id=57XBDQAAQBAJ&oi=fnd&pg=PP1&dq=Clinical+Pathology+and+Biochemistry+ebook&ots=rPd-0sxeno&sig=fFo5lZ6mSyJceEhnAwA8dbwl6NQ#v=onepage&q=Clinical%20Pathology%20and%20Biochemistry%20ebook&f=false
15. https://books.google.co.in/books?id=S4nrnTkBph0C&printsec=copyright&redir_esc=y#v=onepage&q&f=false
16. https://www.kopykitab.com/A-Textbook-Of-Biochemistry-And-Clinical-Pathology-by-Dr-Milind-J-Umekar-R-T-Lohiya-N-R-Kotagale

DMLTS212: Clinical pathology and Biochemistry. (Skill based)

Total credits: 6

List of Practicals-

1. Preparation of standard solutions.
2. Determination of blood glucose and HbA1c.
3. Determination of blood urea and BUN.
4. Determination of serum creatinine.
5. Determination of Total protein and albumin.
6. Determination of Uric acid.
7. Determination of bilirubin.
8. Determination of Lipid profile.
9. Determination of serum SGPT/ SGOT.
10. Determination of serum calcium.
11. Determination of electrolytes in blood.
12. Determination of amino acid by paper chromatography
13. Examinations of urine.
14. Examinations of stool.
15. Examinations of CSF.
16. Examinations of sputum.
17. Examinations of semen.
18. Visit to pathology laboratory.

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DMLTG213: Histopathology (General)

Total credits: 4 **Teaching Hours-60(4 hours/week)**

Aim of the course: The fundamental aim of the course is determination of tissues organization and study of all structural level from cells to organ.

Outcome of the course: Development of proficiency skill of tools, technologies and methods used in histopathology.

Syllabus

Unit-I **Hours -15**

Introduction- Histopathology, Lab: Infrastructure, Equipments for histology and cytology. Use and care of frequently used equipment, preparation of regent solution.

Unit II **Hours -20**

Basic histological technique in laboratory- logging of specimen, preparation of tissue, processing of tissue. frozen section technique, handling and embedding of small tissue fragment.

Unit III **Hours -10**

Fixatives used in histopathology, preparation, advantages & disadvantages, Stains & dyes – Introduction Composition of commonly used stains, mention types of stains.

Unit IV **Hours -10**

Decalcification of Tissues like bones & teeth or other calcified tissues: Decalcifying Methods, Reagents Used and End point methods of Decalcification.

Unit V: **Hours -05**

Mounting of museum specimens: Various Mounting solutions used in mounting, Different types of mounting jars used. Biological Hospital waste disposal & universal Precautions.

References:

1. Carson FL, Edgar LC, Tatum DS. Board of Registry Study Guide: Histotechnology Examinations. 2nd ed. Chicago, IL: ASCP Press; 2001.
2. Ham AW, Cormack DH. Ham's Histology. 9th ed. Philadelphia, PA: Lippincott; 1987
3. Hansen JT. Essential Anatomy Dissector Following Grant's Method. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2002.
4. Lester SC. Manual of Surgical Pathology. 3rd ed. New York, NY: Elsevier; 2010.
5. Praful B. Godkar- Textbook of medical laboratory technology.
6. Kanai L. Mukharjee- Medical laboratory technology- A procedure manual for routine diagnostics tests., vol-3
7. Histopathology, Guy Orchard, Brian Nation OUP Oxford.
8. Robert L. Sorenson, Atlas of Human Histology - Histology Guide
9. Victor P. Eroschenko, Atlas of Histology with Functional Correlations.
10. Geraldine O'Dowd, Phillip Woodford, Wheater's Functional Histology.
11. Handbook of Histopathological and Histochemical Techniques. 3rd Edition, C. F. A. Culling.
12. Paul J. Tadrous , Diagnostic Criteria Handbook in Histopathology: A Surgical Pathology Vade Mecum..
13. Leslie P. Gartner, Color Atlas and Text of Histopathology.
14. https://www.ebooks.com/en-us/subjects/medicine-pathology-ebooks/1186/
15. http://www.freebookcentre.net/medical_text_books_journals/pathology-books-download.html

DMLTS213: Histopathology (Skill based)

Total credits: 6

List of Practicals:

1. Introduction to different types of instruments.
2. Gross examination and fixation of specimen.
3. De calcification of calcified tissue.
4. Tissue processing an staining
5. Sharpening of microtome knife
6. Preparation of paraffin blocks (including the complete processing).
7. Section cutting from a paraffin block.
8. Preparation of a frozen section using a cryostat
9. Preparation of a frozen section using freezing microtome.
10. **Compulsory one month training in pathological laboratory.**