



**Maharashtra State Board of Technical Education, Mumbai**  
Teaching and Examination Scheme

**Programme Name : Advanced Diploma in Medical Laboratory Technology**

**With Effect From Academic Year: 2023 - 24**

**Programme Code : LX**

**Duration : 16 Weeks**

**Duration of Programme : One and Half Years (Three Semesters)**

**Pattern : Semester (Full Time)**

**Examination Scheme**

**Semester : First**

**Duration : 16 Weeks**

**Scheme : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Exam Duration in Hrs.	Theory						Practical						Grand Total
				L	T	P			ESE		PA		Total	ESE		PA		Total			
									Max Marks	Min Marks	Max Marks	Min Marks		Max Marks	Min Marks	Max Marks	Min Marks				
1	Human Anatomy and Physiology	HAP	28128	4	--	2	6	1.5	70*#	35	30*	00	100	50	50#	25	50	25	100	50	200
2	Hematology and Blood Banking	HBB	28043	4	--	4	8	--	--	--	--	--	--	--	50#\$	25	50	25	100	50	100
3	BioChemistry (Medical)	BCM	28129	4	--	4	8	1.5	70*#	35	30*	00	100	50	50#	25	50	25	100	50	200
4	Clinical Pathology	CHO	28044	4	--	4	8	--	--	--	--	--	--	--	50#\$	25	50	25	100	50	100
<b>Total</b>				<b>16</b>	<b>--</b>	<b>14</b>	<b>30</b>	<b>--</b>	<b>140</b>	<b>--</b>	<b>60</b>	<b>--</b>	<b>200</b>	<b>--</b>	<b>200</b>	<b>--</b>	<b>200</b>	<b>--</b>	<b>400</b>	<b>--</b>	<b>600</b>

**Student Contact Hours Per Week: 30 Hrs. Theory and practical periods of 60 minutes each. Medium of Instruction: English Total Marks : 600**

**Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical**

**@ Internal Assessment, # External Assessment, \*# On Line Examination**

**\* The average of 2 test to be taken during the semester for the assessment.**

**#\$ External PR ESE and average of 2 Skill tests / Practicals.**

**@ \$ Internal PR ESE and average of 2 Skill tests / Practicals.**

**If student remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE.**

**> Candidates not securing minimum marks for passing the "PA" part of practical of any course is declared as "Detained" for that semester.**

**> During Internship and Project period students shall attend Institute one day in a week to meet the mentor and appraise about the progress. The log book, Project Diary and Internship performance shall be recorded by the mentor for progressive assessment.**



**Maharashtra State Board of Technical Education, Mumbai**  
**Teaching and Examination Scheme**

**Programme Name : Advanced Diploma in Medical Laboratory Technology**

**Programme Code : LX**

**Duration of Programme : One and Half Years (Three Semesters) Pattern : Semester (Full Time) Duration : 16 Weeks**

**Semester : Second**

**Scheme : I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme												Grand Total			
				L	T	P		Theory						Practical									
								ESE			PA			ESE			PA						
								Max Marks	Min Marks	Exams	Max Marks	Min Marks	Total	Max Marks	Min Marks	Total	Max Marks	Min Marks	Total				
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	(n+t)	
1	Medical Microbiology	MXS	28216	4	--	4	08	1.5	70*#	35	30*	00	00	100	50	50#	25	50	25	100	50	50	200
2	Histotechnology and Cytotechnology	HGC	28739	4	--	4	08	--	--	--	--	--	--	--	--	50#\$	25	50	25	100	50	50	100
3	Advanced Techniques and Future Trends in Laboratory Science	ATF	28217	4	--	4	08	1.5	70*#	35	30*	00	00	100	50	50#	25	50	25	100	50	50	200
4	Laboratory Management and Ethics	LME	28092	4	--	2	6	--	--	--	--	--	--	--	--	50#\$	25	50	25	100	50	50	100
<b>Total</b>				<b>16</b>	<b>--</b>	<b>14</b>	<b>30</b>	<b>--</b>	<b>140</b>	<b>--</b>	<b>120</b>	<b>--</b>	<b>200</b>	<b>--</b>	<b>200</b>	<b>--</b>	<b>200</b>	<b>--</b>	<b>200</b>	<b>--</b>	<b>400</b>	<b>--</b>	<b>600</b>

**Student Contact Hours Per Week: 30 Hrs. Theory and practical periods of 60 minutes each. Medium of Instruction: English Total Marks : 600**

**Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical**

**@Internal Assessment, # External Assessment, \*# On Line Examination**

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**@\$\$ Internal PR ESE and average of 2 Skill tests / Practicals.**

**If student remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE.**

**> Candidates not securing minimum marks for passing the "PA" part of practical of any course is declared as "Detained" for that semester.**

**> During Internship and Project period students shall attend Institute one day in a week to meet the mentor and appraise about the progress. The log book, Project Diary and Internship performance shall be recorded by the mentor for progressive assessment.**





**Maharashtra State Board of Technical Education, Mumbai**  
**Teaching and Examination Scheme**

**Programme Name : Advanced Diploma in Medical Laboratory Technology**

**With Effect From Academic Year: 2023 - 24**

**Programme Code : LX**

**Duration of Program : One and Half Years (Three Semesters)**

**Duration : 16 Weeks**

**Semester : Third**

**Pattern : Semester (Full Time)**

**Scheme : I**

S. No.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Exam Duration in Hrs.	Theory						Practical						Grand Total
				L	T	P			ESE		PA		Total	Min Marks	ESE		PA		Total	Min Marks	
									Max Marks	Min Marks	Max Marks	Min Marks			Max Marks	Min Marks	Max Marks	Min Marks			
a	b	c	d	e	f	g	h(e+f+g)	i	j	k	l	m	n(j+l)	o	p	q	r	s	t(h+p+r)	u	v(n+t)
1	Project and Seminar	PLX	28726	-	-	10	10	--	--	--	--	--	--	--	50#	25	50	25	100	50	100
2	Hospital Training	PHT	28727	-	-	20	20	--	--	--	--	--	--	--	100#	50	100	50	200	100	200
<b>Total</b>				-	-	<b>30</b>	<b>30</b>	--	--	--	--	--	--	--	<b>150</b>	--	<b>150</b>	--	<b>300</b>	--	<b>300</b>

**Student Contact Hours Per Week: 30 Hrs. Theory and practical periods of 60 minutes each. Medium of Instruction: English Total Marks : 300**

**Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical**

**@Internal Assessment, # External Assessment, \*# On Line Examination**

**\* The average of 2 test to be taken during the semester for the assessment.**

**#\$ External PR ESE and average of 2 Skill tests / Practicals.**

**@\$ Internal PR ESE and average of 2 Skill tests / Practicals.**

**If student remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE.**

**> Candidates not securing minimum marks for passing the "PA" part of practical of any course is declared as "Detained" for that semester.**

**> During Internship and Project period students shall attend Institute one day in a week to meet the mentor and appraise about the progress. The log book, Project Diary and Internship performance shall be recorded by the mentor for progressive assessment.**

**Note : The Institute is required to sign MOU with related local authorities for Hospital Training**





Subject: Engineering Mathematics - I  
 Chapter: Trigonometry

Topic: Trigonometric Identities

Section: Trigonometric Identities

Sub-section: Trigonometric Identities

Sl. No.	Q. No.	Q. Text	Ans.
1	1	Prove that $\sin^2 \theta + \cos^2 \theta = 1$	Let $\theta$ be an acute angle. Then, in a right-angled triangle, $\sin \theta = \frac{opposite}{hypotenuse}$ and $\cos \theta = \frac{adjacent}{hypotenuse}$ . Squaring both and adding, we get $\sin^2 \theta + \cos^2 \theta = \frac{opposite^2 + adjacent^2}{hypotenuse^2} = \frac{hypotenuse^2}{hypotenuse^2} = 1$ .
2	2	Prove that $\sec^2 \theta = 1 + \tan^2 \theta$	We know $\sec \theta = \frac{1}{\cos \theta}$ and $\tan \theta = \frac{\sin \theta}{\cos \theta}$ . So, $\sec^2 \theta = \frac{1}{\cos^2 \theta}$ and $1 + \tan^2 \theta = 1 + \frac{\sin^2 \theta}{\cos^2 \theta} = \frac{\cos^2 \theta + \sin^2 \theta}{\cos^2 \theta} = \frac{1}{\cos^2 \theta} = \sec^2 \theta$ .
3	3	Prove that $\csc^2 \theta = 1 + \cot^2 \theta$	We know $\csc \theta = \frac{1}{\sin \theta}$ and $\cot \theta = \frac{\cos \theta}{\sin \theta}$ . So, $\csc^2 \theta = \frac{1}{\sin^2 \theta}$ and $1 + \cot^2 \theta = 1 + \frac{\cos^2 \theta}{\sin^2 \theta} = \frac{\sin^2 \theta + \cos^2 \theta}{\sin^2 \theta} = \frac{1}{\sin^2 \theta} = \csc^2 \theta$ .
4	4	Prove that $\sec^2 \theta - \tan^2 \theta = 1$	$\sec^2 \theta - \tan^2 \theta = \frac{1}{\cos^2 \theta} - \frac{\sin^2 \theta}{\cos^2 \theta} = \frac{1 - \sin^2 \theta}{\cos^2 \theta} = \frac{\cos^2 \theta}{\cos^2 \theta} = 1$ .
5	5	Prove that $\csc^2 \theta - \cot^2 \theta = 1$	$\csc^2 \theta - \cot^2 \theta = \frac{1}{\sin^2 \theta} - \frac{\cos^2 \theta}{\sin^2 \theta} = \frac{1 - \cos^2 \theta}{\sin^2 \theta} = \frac{\sin^2 \theta}{\sin^2 \theta} = 1$ .

Signature: \_\_\_\_\_

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**PROGRAMME NAME** : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY  
**PROGRAMME CODE** : LX  
**SEMESTER** : FIRST  
**COURSE TITLE** : HUMAN ANATOMY & PHYSIOLOGY  
**COURSE CODE** : 28128

### 1. RATIONALE

The purpose of including this subject is to provide the students with knowledge of the structure and function of a healthy human body.

### 2. COMPETENCY

The student will be able to identify various systems and organs in the human body, use and apply common anatomical terms with meaning, and describe working of various systems in the human body.

### 3. COURSE OUTCOMES

- Student will get an idea about basic structure of human body, orientation, their different systems and functions.
- Structure and function of heart and process of circulation, including measuring blood pressure
- Structure and function of lungs and respiratory tract and mechanism of breathing.
- Structure and function of organs involved in digestion.
- Structure and function of excretory system and reproductive system, including menstrual cycle.
- Names and functions of various hormones. Parts of brain and their main functions.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Paper Hrs.	Theory						Practical					
			ESE		PA		Total		ESE		PA		Total			
			Max		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	--	2	6	1.5	70*#	35	30*	00	100	50	50#	25	50	25	100	50

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@): Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical - ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

**Note:** If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

**Legends:** L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, \*#Online Examination



**5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES**

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Measurement of TPR
2	Measurement of Blood Pressure
3	Study of different types of bones of body using human skeleton and bone set
4	Study of different types of joints using human skeleton
	<b>With the help of models and charts study structure (Anatomy) and functions of</b>
5	Cardio-Vascular System
6	Respiratory System
7	Digestive System
8	Male Reproductive System
9	Female Reproductive System
10	Excretory System
11	Endocrine glands
12	Different parts of brain and Spinal cord
13	Circulation of CSF
14	Surface Anatomy of Heart, lungs, Kidneys, Liver, Spleen
15	Visit of Anatomy Museum

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	Human Skeleton
2	Human Bone set
3	BP Apparatus
4	Thermometer
5	Stethoscope

**7. THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours	Marks
I	<b>Introduction:</b> 1.1. Different system of Human body 1.2. Cell- Structure & function. 1.3. Body Tissue – their functions 1.4. Common anatomical terms (Anterior/Ventral, lateral, medial, median, posterior/dorsal etc.) 1.5. Anatomical Position & Planes (Supine, prone, recumbent, lithotomy) planes- coronal ,sagittal. 1.6. <b>Skeletal System:</b> Names and types of bones and joints.	16	10
II	<b>Cardio Vascular System:</b> 2.1 Structure of Heart & its coverings, major Blood vessels- arteries & veins	10	12

Unit	Topic and Contents	Hours	Marks
	2.2 Structure of Blood vessels 2.3 Cardiac cycle, cardiac output 2.4 Blood pressure, factors affecting it.		
III	<b>Respiratory System:</b> 3.1 Respiratory tract structure 3.2 Lungs structure 3.3 Mechanism of respiration 3.4 Vital Capacity.	06	12
IV	<b>Digestive Systems</b> 4.1 Teeth, Tongue, Salivary Glands, Tonsils, Stomach, Intestine: small, large 4.2 Rectum, Anal Canal, Liver, Pancreas, Gall Bladder 4.3 Digestion & Absorption of proteins, fats & carbohydrate.	08	12
V	<b>Genito-Urinary System and Skin:</b> 5.1 Structure and functions of the Skin 5.2 Kidney –Ureter, Bladder 5.3 Kidney – Structure & Function of Nephron 5.4 Mechanism of urine formation, maintenance of acid base balance and electrolyte balance, Osmosis, Isotonic, Hypotonic, Hypertonic solution. 5.5 Testis- Vas deferens, prostate, Seminal vesicles, 5.6 Ovaries, uterus, fallopian tubes, cervix and vagina.	12	12
VI	<b>Endocrine System &amp; Central Nervous System:</b> 6.1 Syndromes resulting from hypo and hyper activity of thyroid, parathyroid, adrenal, pituitary, pancreas. 6.2 Physiology of reproduction, menstruation, pregnancy and lactation 6.3 Brain – Coverings 6.4 Parts of brain, function, Spinal cord, peripheral nerves	12	12
<b>Total</b>		<b>64</b>	<b>70</b>

### 8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction	16	06	02	02	10
II	Cardio Vascular System	10	06	04	02	12
III	Respiratory System	06	06	04	02	12
IV	Digestive Systems	08	06	04	02	12
V	Genito-Urinary System and Skin	12	06	04	02	12
VI	Endocrine System & Central Nervous System	12	06	04	02	12
<b>Total</b>		<b>64</b>	<b>36</b>	<b>12</b>	<b>12</b>	<b>70</b>

Legends: R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)



Note: The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

### 9. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Diagrammatically show various joints in normal human body.
- Diagrammatically represent flow of CSF.
- Diagrammatically and schematically show process of circulation.
- Draw and name various endocrine glands. Mention names of hormones.
- Diagrammatically show structure of nephron with labels.
- Record the Blood pressure of 10 subjects and write values and interpret it.

### 10. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Human Physiology	C. C. Chaterjee	Medical Allied Agencies, Calcutta
2	Anatomy & Physiology in health & illness	Ross & Wilson	ELBS, Churchill Livingstone, Medical Division of Longman group (FE) Ltd
3	Human Anatomy (Vol 1, 2, 3)	B. D. Chaurasia	CBS, New Delhi
4	Surface Anatomy	Dr. Halim	
5	Anatomy & Physiology for Nurses	Evelyn Pearce	Jaypee Brothers

### 11. SOFTWARE/LEARNING WEBSITES

- <https://teachmeanatomy.info/>
- <https://www.lonestar.edu/anatomy-and->
- <https://www.bartleby.com/107/>
- <https://www.getbodysmart.com/>
- <https://aclandanatomy.com>



**PROGRAMME NAME : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY**

**PROGRAMME CODE : LX**

**SEMESTER : FIRST**

**COURSE TITLE : HEMATOLOGY AND BLOOD BANKING**

**COURSE CODE : 28043**

### 1. RATIONALE

This branch of laboratory science deals with study of blood, its components and changes it undergoes during illness. While blood banking is a science which deals with collecting, testing and transfusing blood and its products for replacement of lost blood.

### 2. COMPETENCY

Students will learn about the normal formation and function of various types of blood cells, coagulation processes and laboratory process to measure these components. This subject shall also make the students acquainted to immunohematology and basics of blood banking.

### 3. COURSE OUTCOMES

- Composition of blood and tools for sample collection.
- Different cell components of blood, their formation & function of various types
- Coagulation mechanism & various factors that constitute the process of coagulation.
- Bone marrow slide preparation, staining method and microscopic findings that make it different from peripheral smear.
- Basics of immunohematology and theory behind the processes in blood banks,
- Various tests required before blood transfusion and importance of blood component therapy.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
			Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	--	4	8	--	--	--	--	--	--	50#\$	25	50	25	100	50

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

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**Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P --Practical, ESE -End Semester Examination, PA - Progressive Assessment**

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**5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES**

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Hemoglobin Estimation – Sahli's Method/ Drabkin's Method
2	RBC Count, Total WBC Count
3	Differential WBC Count.
4	Peripheral Smear preparation and microscopy
5	Reticulocyte count
6	E.S.R determination
7	Platelet Count
8	Bleeding Time and Clotting Time
9	Prothrombin time/Partial Thromboplastin time
10	G6PD Test
11	Sickle Cell Preparation
12	ABO Grouping & Rh typing– (a) Slide technique, (b) Tube technique, (c) Reverse and forward grouping
13	Cross matching – Major and Minor
14	Coombs test (a) Direct coombs, (b) Indirect coombs
15	Antibody Titre: Technique and significance.

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned

Sr. No.	Equipment Name with Broad Specifications
1	3 part differential cell counter
2	Hemocytometer
3	Hemoglobinometer
4	Vein puncture set, Needles and Syringes
5	Water bath
6	Wintrobe's tube with stand, Pasteur pipette
7	Westergren pipette with ESR stand
8	Anti sera A, B, D
9	Different reagents- diluting fluids, N/10 HCl
10	Different glassware
11	Colorimeter
12	Capillaries tubes / Blotting paper / stop watch
13	Prothrombin time kit
14	G6PD Kit
15	Sodium metabisulphite (100 Gram)
16	Coomb's test kit (direct & indirect)

**7. THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours
I	<b>Hematology:</b> 1.1 Introduction :- Composition of blood, its formation and	



Unit	Topic and Contents	Hours
	<p>functions</p> <p>1.2 Collection of blood :- Different routes ,difference between capillary ,venous and arterial blood sample</p> <p>1.3 Anticoagulants :- Different types and uses</p> <p>1.4 Collection tubes, Types and order of draw</p>	08
II	<p><b>2.1 Hemoglobin</b></p> <ul style="list-style-type: none"> <li>• Normal and abnormal values and Physiological variations</li> <li>• Estimation by (a) Colorimetric Method, (b) Chemical Method, (c) Specific Gravity Method, (d) Gasometric Method</li> <li>• Clinical importance</li> </ul> <p><b>2.2 Red Blood Cells:-</b></p> <ul style="list-style-type: none"> <li>• Total Count :- Normal, abnormal values, and Physiological variations,</li> <li>• Hemocytometer - method and calculation</li> <li>• Anemia –Classification</li> <li>• Sickle cell anemia – Slide Preparation</li> <li>• Hematocrit – Normal and abnormal values</li> <li>• Red Cell indices – Normal and abnormal values</li> <li>• Erythrocyte Sedimentation Rate</li> <li>• Westergren &amp; Wintrobe's Method Factors affecting ESR values Limitations and Significance</li> <li>• G6PD</li> </ul>	14
III	<p><b>White Blood Cells:-</b></p> <p>3.1 Differential Count :- Normal, abnormal values and physiological variation</p> <p>3.2 Preparation of peripheral blood smear, Staining by different methods, Methods of examinations and reporting</p> <p>3.3 Total White Blood Cell Count :- Normal and abnormal values,</p> <p>3.4 Hemocytometer - method and calculation</p> <p>3.5 Reticulocytes :- Methods, Normal values and significance</p>	14
IV	<p><b>4.1 Hemostasis and Coagulation Mechanism and Bone Marrow</b></p> <ul style="list-style-type: none"> <li>• Coagulation Factors</li> <li>• Coagulation Test – (a) Bleeding time, (b) Clotting time, (c) Prothrombin time (PT), (d) Activated Partial Thromboplastin time (APTT) (e) D-dimer</li> </ul> <p><b>4.2 Bone Marrow :-</b></p> <ul style="list-style-type: none"> <li>• Smear Preparation,</li> <li>• Staining,</li> <li>• Examination and Report</li> </ul>	08
V	<p><b>Blood Banking</b></p> <p>5.1 Introduction : Immunohematology</p> <p>5.2 ABO blood group system :- Sub groups, Source of antigens Types of antibodies</p> <p>5.3 Rh blood group system – Nomenclature, Types of antigen.</p>	10

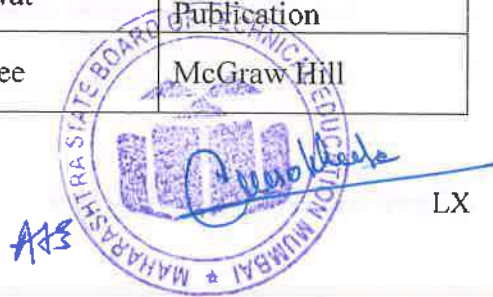
Unit	Topic and Contents	Hours
	Types of antibodies 5.4 Other blood group systems such as MNS, Kell, and Bombay Blood group - complete knowledge of theory and genetics. 5.5 Technique of blood grouping and cross matching 5.6 Coomb's test <ul style="list-style-type: none"> <li>• Direct and Indirect test,</li> <li>• Titration of antibodies - complete and incomplete</li> </ul>	
<b>VI</b>	<b>Blood Transfusion</b> 6.1 Blood transfusion technique <ul style="list-style-type: none"> <li>• Preparation and properties of anticoagulant solution,</li> <li>• Criteria for selection of donor,</li> <li>• Screening test for donor,</li> <li>• Method of collection of blood,</li> <li>• Clearing and assembling of blood transfusion apparatus</li> </ul> 6.2 Transfusion Reactions & Investigation of transfusion reaction. 6.3 Cell preparation and transfusion of various components of blood. 6.4 Organization, operation, administration of blood bank and maintenance of records, 6.5 Govt. Regulations(FDA)	<b>10</b>
<b>Total</b>		<b>64</b>

### 8. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Perform blood grouping of 20 different subjects and report it.
- Schematically represent coagulation mechanism.
- Draw diagrams of various types of WBCs.
- Do Hb estimation of 10 males and 10 females and report it.

### 9. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Practical Hematology	John Dacie & S. M. Lewis	Churchil Livingston
2	Blood Bank Operations	G. Guru	NCERT, New Delhi.
3	Text Book of Medical Laboratory Technology	P.B. Godkar	Bhalani Publication
4	Essentials of Hematology	Dr. Shirish Kawthalkar	Jaypee
5	ABC of CBC	Lokwani	Jaypee
6	P.J.Mehta's Practical Pathology	Munjal Shah	The National Book Depot
7	Basics in Microbiology and Haematology	Dhiraj Shekhawat	Neeraj Publication
8	Medical Laboratory Techniques, Vol - I, II & III	Kanai Mukharjee	McGraw Hill



### 10. SOFTWARE/LEARNING WEBSITES

- <https://hematologyacademy.com/scientific-education/>
- <https://www.blood-academy.com/>
- <http://naco.gov.in/blood-transfusion-services-publications>
- <http://nbt.c.naco.gov.in/assets/resources/training/18A.pdf>



**PROGRAMME NAME** : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

**PROGRAMME CODE** : LX

**SEMESTER** : FIRST

**COURSE TITLE** : BIOCHEMISTRY (MEDICAL)

**COURSE CODE** : 28129

### 1. RATIONALE

Medical biochemistry is a study of chemical components of human body, their metabolism process in the body and functions and utility offered for life. Estimation of chemical molecules is essential to know disease process at molecular level and thus biochemistry help us to identify abnormal function at earlier stage of diseases and it is also useful for prognostic purpose.

### 2. COMPETENCY

Students will get familiar with the names of medically relevant biochemical processes and molecules of the human body, and their estimation.

### 3. COURSE OUTCOMES

- Introduction to biochemistry basics, to create a foundation of concepts and processes under biochemistry.
- Medically relevant biochemical compounds, their functions, and utility in the human body
- Acid base balance of the body, along with measurement of drug levels and substance abuse.
- Amalgamating all the knowledge of previous chapters into practically relevant tests, currently in use.
- Role of hormones and enzymes in disease.
- Various organ profiles test and their importance.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
			Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
Max	Min	Max		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
4	--	4	8	1.5	70*#	35	30*	00	100	50	50#	25	50	25	100	50

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@): Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical - ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

**Note:** If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

**Legends:** L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, \*#Online Examination



**5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES**

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Principles and working of Laboratory Instruments
2	Calibration of apparatus and glassware
3	Preparation and Standardization of volumetric solutions
4	Estimation of blood sugar
5	Estimation of urea and creatinine
6	Estimation of uric acid
7	Estimation of plasma proteins, albumin and A/G ratio
8	Estimation of bilirubin
9	Estimation of transaminases
10	Estimation of alkaline phosphatase
11	Estimation of amylase and lipase
12	Estimation of cholesterol and its types
13	Estimation of triglycerides
14	Estimation of calcium and inorganic phosphorus
15	Estimation of electrolytes (sodium, potassium, chloride)

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Major Equipment Name with Broad Specifications
1	Semi-automated Biochemistry analyzer
2	Colorimeter
3	Different test kits
4	Different glassware
5	Centrifuge

**7. THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours	Marks
I	<b>Elementary Knowledge</b> Elementary knowledge of inorganic chemistry <ul style="list-style-type: none"> <li>• Structure of atom, atomic weight, molecular weight and equivalent weight</li> <li>• Units of Measurement</li> <li>• Acids, bases and salts</li> <li>• pH indicators - pH meter – pH measurement</li> <li>• Molar solutions</li> <li>• Normal solutions</li> <li>• Buffer solutions</li> <li>• Percent solution</li> <li>• Saturated solution</li> <li>• Standard solutions</li> </ul>	08	10
II	<b>Analytical Instruments</b>	10	12

Unit	Topic and Contents	Hours	Marks
	<ul style="list-style-type: none"> <li>Principles, instrumentation, working, uses, care and maintenance</li> <li>Balances: monopan, two pan</li> <li>Centrifuges</li> <li>pH meter</li> <li>Colorimeter</li> <li>Spectrophotometer</li> <li>Flame photometer</li> <li>Ion selective Electrodes</li> </ul>		
<b>III</b>	<b>Clinical Biochemistry</b> 3.1 Carbohydrates: Basic metabolism, regulation of blood glucose & its importance, glucose tolerance test, glycosylated Hb, Hypo and Hyper Glycaemia, Diabetes Mellitus 3.2 Lipids: Basic metabolism, lipid profile (cholesterol, triglyceride, lipoproteins, phospholipids) 3.3 Proteins: Fate of amino acids, formation and detoxication of ammonia, formation of urea, Purine metabolism and formation of uric acid	<b>12</b>	<b>12</b>
<b>IV</b>	<b>Enzymes and Hormones</b> 4.1 Enzymes: <ul style="list-style-type: none"> <li>Classification, properties, factors affecting enzyme activity, isoenzymes and coenzymes.</li> <li>Clinical enzymology: Therapeutic, diagnostic and analytical uses of enzymes with normal values of serum enzymes.</li> </ul> 4.2 Hormones: <ul style="list-style-type: none"> <li>Names and biochemical functions.</li> </ul> 4.3 Minerals and Electrolytes: <ul style="list-style-type: none"> <li>Na, K, Cl, Ca, Mg, P, Fe and iron binding capacity.</li> </ul>	<b>10</b>	<b>12</b>
<b>V</b>	<b>Special Biochemistry</b> 5.1 Acid Base Balance: Regulation of blood pH, Henderson Hasselbach equation, renal, respiratory and buffer system, importance of arterial blood gases 5.2 Therapeutic drug monitoring and Drugs of abuse: Names of Drugs and Types of Sample Collection	<b>10</b>	<b>12</b>

Unit	Topic and Contents	Hours	Marks
VI	<b>Organ Profiles</b> 6.1 Liver function test: Bilirubin, Proteins, SGOT, SGPT, Alkaline phosphatase, GGTP 6.2 Kidney function test: Urea, Creatinine, Electrolytes, Uric acid 6.3 Cardiac function test (Trop-I/T, CPK-MB, NT- Pro BNP) 6.4 Pancreas function test: amylase, lipase 6.5 Diabetic tests: fasting sugar, post-prandial sugar, post glucose sugar, glucose tolerance test, glycosylated hemoglobin 6.6 Anemia Profile : Hb, CBC-indices, Peripheral smear, Fe, TIBC, Transferrin Saturation, Vitamin B12 6.7 Infertility & PCOS tests 6.8 ANC Profile	14	12
<b>Total</b>		<b>64</b>	<b>70</b>

### 8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Elementary Knowledge	08	06	02	02	10
II	Analytical Instruments	10	06	04	02	12
III	Clinical Biochemistry	12	06	04	02	12
IV	Enzymes and Hormones	10	06	04	02	12
V	Special Biochemistry	10	06	04	02	12
VI	Organ Profiles	14	06	04	02	12
<b>Total</b>		<b>64</b>	<b>36</b>	<b>22</b>	<b>12</b>	<b>70</b>

**Legends:** R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)

**Note:** The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

### 9. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

- Prepare in tabular form different enzymes, normal values and their diagnostic significance.
- Prepare in tabular form different hormones, normal values and diagnostic significance
- Prepare in tabular form important minerals, normal values and their diagnostic significance.

### 10. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Harper's Illustrated Biochemistry	Murray et. al	Lange
2	Handbook of Biochemistry	M A Siddique	Vijay Bhagat Scientific Book Co, Patna
3	Textbook of Medical Laboratory Technology	Praful Godkar	Bhalani

Sr. No.	Title of Book	Author	Publication
4	PJ Mehta's Practical Pathology	Munjal Shah	The National Book Depot
5	Practical Clinical Biochemistry	Harold Varley	CBS Publishers
6	Biochemistry	Satyanarayan	Elsevier
7	Medical Laboratory Techniques, Vol - I, II & III	Kanai Mukharjee	McGraw Hill

#### 11. SOFTWARE/LEARNING WEBSITES

- <https://www.easybiologyclass.com/topic-biochemistry/>://www.freesunpower.com
- <https://www.mednotes.in/2019/10/biochemistry.html>

**PROGRAMME NAME : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY**

**PROGRAMME CODE : LX**

**SEMESTER : FIRST**

**COURSE TITLE : CLINICAL PATHOLOGY**

**COURSE CODE : 28044**

### 1. RATIONALE

Students will understand significance of studying various body fluids (physical, chemical & microscopic examination) in various pathological conditions.

### 2. COMPETENCY

Student will learn the normal composition of various body fluids & feces & significance in various clinical conditions.

### 3. COURSE OUTCOMES

- Students will develop skills regarding proper collection of sample and its storage as well as transportation. They get knowledge of changes occurring in various disease conditions.
- Methods of collection of stool and slide preparation for microscopy is an important criterion. Students will come to know different concentration techniques.
- Collection of sputum is one of the important parts of sputum examination and also staining for AFB.
- Semen analysis is an important and basic test investigation in case of infertility profile. Collection and transportation is of utmost importance.
- CSF examination will reveal its significance in different pathological conditions.
- Various body fluids examination will reveal its significance in different pathological conditions

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme													
L	T	P		Theory						Practical							
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
			Max		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
4	--	4	8	--	--	--	--	--	--	50#\$	25	50	25	100	50		

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#\$) or (@\$) : Under the practical ESE - 50 Marks (100%)

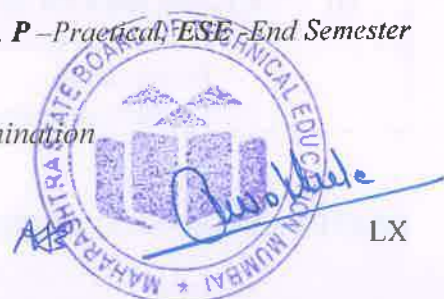
1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

**Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE**

**Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE-End Semester Examination, PA - Progressive Assessment**

@Internal Assessment, #External Assessment, \*#Online Examination



**5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES**

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Sample collection and physical examination of Urine
2	Chemical examination of Urine
3	Microscopic examination of Urine
4	Sample collection and physical examination of Stool
5	Chemical and Microscopic examination of stool
6	Sample collection and physical examination of sputum
7	Chemical and Microscopic examination of sputum
8	Sample collection and physical examination of semen
9	Chemical and Microscopic examination of semen
10	Sample collection and physical examination of CSF
11	Chemical and Microscopic examination of CSF
12	Sample collection and physical examination of Ascitic fluid
13	Chemical and Microscopic examination of Ascitic fluid
14	Sample collection and physical examination of synovial fluid
15	Chemical and Microscopic examination of synovial fluid

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	Dip sticks
2	Different glassware
3	Different reagents
4	Neubauer chamber

**7. THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours
<b>I</b>	<b>Urine examination</b> 1.1 Indication, Collection ,Container, Transport and Preservation 1.2 Physical examination and its significance 1.3 Chemical examination and its significance 1.4 Microscopic examination and its significance	<b>16</b>
<b>II</b>	<b>Examination Of Stool</b> 2.1 Indication, Collection ,Container ,Transport and Preservation 2.2 Physical examination and its significance 2.3 Chemical examination and its significance 2.4 Microscopic examination and its significance 2.5 Stool concentration technique	<b>14</b>
<b>III</b>	<b>Examination Of Sputum</b> 3.1 Indication, Collection, Container, Transport and Preservation 3.2 Physical examination and its significance	<b>10</b>



Unit	Topic and Contents	Hours
	3.3 Microscopic examination and its significance 3.4 Sputum concentration technique	
IV	<b>Semen Analysis</b> 4.1 Indication, Collection, Container, Transport and Preservation 4.2 Physical examination and its significance 4.3 Chemical examination and its significance 4.4 Microscopic examination and its significance	12
V	<b>Examination of CSF And Synovial Fluid,</b> 5.1 Indication, Collection, Container, Transport and Preservation 5.2 Physical examination and its significance 5.3 Chemical examination and its significance 5.4 Microscopic examination and its significance	06
VI	<b>Examination of Other Body Fluids Like Pleural Fluid, Pericardial Fluid, Peritoneal Fluid</b> 6.1 Indication, Collection, Container, Transport and Preservation 6.2 Physical examination and its significance 6.3 Chemical examination and its significance 6.4 Microscopic examination and its significance	06
<b>Total</b>		<b>64</b>

### 8. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

- Do the AFB staining of 10 samples and interpret.
- Find out commonly seen parasites in stool sample (10 samples).

### 9. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Medical Laboratory Techniques, Vol - I, II & III	Kanai Mukharjee	Tata McGraw Hill, Delhi.
2	Pathological Technology Clinical Pathology	G. Guru	National Council of Educational Research & Training, New Delhi
3	Essentials of Clinical Pathology	Dr. Shirish Kawthalkar	Jaypee
4	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani
5	Text Book of Medical Laboratory Technology	Munjhal Shah	The National Book Depot
6	Text Book of Medical Laboratory Technology	S. S. Kelkar	Vora medical Publications, Mumbai

### 10. SOFTWARE/LEARNING WEBSITES

- <http://www.freesunpower.com>
- <https://pathologytestsexplained.org.au/learning/test-index/body-fluid>
- labs for life project -clinical pathology



**PROGRAMME NAME** : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY  
**PROGRAMME CODE** : LX  
**SEMESTER** : SECOND  
**COURSE TITLE** : MEDICAL MICROBIOLOGY  
**COURSE CODE** : 28216

### 1. RATIONALE

Medical microbiology is the study of microbiological organisms that cause diseases in humans. This helps us to understand ways in which we can isolate, grow and identify an organism from the diseased human, thus guiding its treatment. This knowledge also helps us to find ways of preventing spread of disease in the community at large.

### 2. COMPETENCY

To understand the morphology of medically important micro-organisms, sterilization and disinfections techniques, immunity, antigen-antibody reaction and serological reaction. To develop the skill of various techniques of identification and culture of these microbes.

### 3. COURSE OUTCOMES

- A general introduction to bacteriology, classification with examples,
- Methods of culture and sterilization.
- Basic concepts of serology and immunology.
- Medically relevant parasites causing diseases in humans, especially in India.
- Medically important fungi causing disease in humans, along with their classification and morphology.
- Classification and properties of viruses, and what makes them increasingly important microbes in the modern world.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Paper Hrs.	Theory						Practical					
					ESE		PA		Total		ESE		PA		Total	
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	-	4	08	1.5	70*#	35	30*	00	100	50	50#	25	50	25	100	50

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@): Under the practical ESE - 50 Marks (100%)

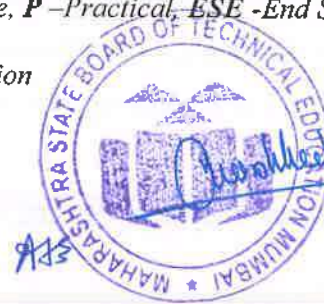
1) 30 Marks (60%) - For Practical - ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

**Note:** If student Remaining absent in PR-ESE shall be considered as **ABSENT** in PR-ESE

**Legends:** L-Lecture, T - Tutorial/Teacher Guided Theory Practice, P -Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, \*#Online Examination



**5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES**

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Microscope - Construction, Care & use and practice of Gram staining technique
2	Morphology of bacteria - Size, Shape, Arrangement, Capsule, Spore, Flagella etc.
3	Practice of Z. N. staining and Hanging drop method Formality
4	Sterilization and disinfection – Autoclave and hot air oven
5	Common Culture media - Liquid and solid :- Preparation, Sterilization, and uses
6	Biochemical reactions- Commonly used biochemical test including sugar fermentation, IMViC, Urease, Oxidase , Coagulase, Catalase
7	Antibiotic susceptibility testing Kirby-Bauer method
8	Agglutination and precipitation
9	Widal test, Bacterial slide Agglutination test, VDRL, RPR test, R.A. test, CRP test, ASO test, Mauntoux test.
10	Agar gel diffusion test (AGD), Single Radial immuno- diffusion test(SRID)
11	Enzyme Linked Immuno-Sorbent assay(ELISA)
12	Collection and processing of skin scrappings / nail clippings / hair pieces / clinical material for demonstration of fungal elements
13	Microscopy for fungal elements : KOH mount and Lactophenol cottonblue mount.
14	Demonstration of common fungal media with and without growth
15	Instruments / Equipment and glassware used in viral diagnostic laboratory
16	Inoculation of chick-embryo and other cell / tissue culture media.

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	Student's Binocular / Monocular Microscope
2	Gram Stain , ZN Stain kits,
3	Autoclave and hot air oven
4	Dehydrated Media ( Nutrient Agar / Mac Conky's / MH Agar)
5	Biochemical Reagents ( IMViC , Urease , Oxidase , Catalase )
6	Antibiotic susceptibility testing kits ( Gram Positive / Negative / Antibiotic discs )
7	Widal Test, ASO Test , Mantoux Test ,CRP Test Kits

**7. THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours	Marks
<b>I</b>	<b>BACTERIOLOGY I</b> 1.1 Introduction to microbiology – Classification, morphology of Bacteria. 1.2 Common methods of sterilization and disinfections 1.3 Cultivation of bacteria • Bacterial growth requirement – Aerobic and anaerobic and mycobacteria • Common media - Classification,	<b>12</b>	<b>10</b>

Unit	Topic and Contents	Hours	Marks
	<p>preparation, sterilization and uses.</p> <ul style="list-style-type: none"> <li>• Culture methods – sample collection transportation, steps in processing the sample, choice of medium, methods of plating, and subcultures</li> </ul>		
<b>III</b>	<p><b>BACTERIOLOGY II</b></p> <p>2.1 Gram Positive cocci - Morphology, pathogenicity and Lab Diagnosis.</p> <ul style="list-style-type: none"> <li>• Staphylococci including MRSA</li> <li>• Streptococci and pneumococci</li> </ul> <p>2.2 Gram Negative cocci – Morphology, pathogenicity and Lab Diagnosis.</p> <ul style="list-style-type: none"> <li>• Meningococci</li> <li>• Gonococci</li> </ul> <p>2.3 Gram Negative Bacilli – Morphology, pathogenicity and Lab Diagnosis</p> <ul style="list-style-type: none"> <li>• E.coli, Klebsiella</li> <li>• Proteus, Pseudomonas</li> <li>• Salmonellae, Shigella, Vibrio</li> </ul> <p>2.4 Gram positive Bacilli and Anaerobes - Morphology, pathogenicity and Lab Diagnosis: Corynebacteria &amp; Clostridia</p> <p>2.5 Mycobacteria - Morphology, pathogenicity and Lab Diagnosis: M. tuberculosis, Atypical mycobacteria and M leprae</p> <p>2.6 Spirochaetes - Treponema, leptospira, Antimicrobial susceptibility test, Preservation of stock cultures</p>	<b>14</b>	<b>12</b>
<b>III</b>	<p><b>IMMUNOLOGY AND SEROLOGY</b></p> <p>3.1 Immunity - Introduction, types of immunity Antigen, Antibody and Complement</p> <p>3.2 Antigen antibody reaction and common serological reaction</p> <p>3.3 Humoral and cell mediated immunity</p> <p>3.4 Auto immunity – Definition with examples</p>	<b>10</b>	<b>12</b>
<b>IV</b>	<p><b>PARASITOLOGY</b></p> <p>4.1 Morphology and Laboratory diagnosis of protozoa such as :</p> <ul style="list-style-type: none"> <li>• E. histolytica and E. coli,</li> <li>• Giardia,</li> <li>• Trichomonas,</li> <li>• Plasmodia</li> </ul> <p>4.2 Morphology and Laboratory diagnosis of following helminths and nematodes :-</p> <ul style="list-style-type: none"> <li>• Hook worm, Round worm, Whip worm, Thread worm</li> <li>• Tapeworm , Wucheria bancrofti</li> </ul>	<b>12</b>	<b>12</b>

Unit	Topic and Contents	Hours	Marks
V	<b>MYCOLOGY</b> 5.1 Morphology and classification of pathogenic and opportunistic fungi and Lab diagnosis of Actinomycetes , Nocardia, Histoplasma, Cryptococcus, Dermatophytes, Candidiasis, Pneumocystic Carnii, Aspergilosis	08	12
VI	<b>VIROLOGY</b> 6.1 Classification, general properties of viruses 6.2 Morphology, pathogenicity and laboratory diagnosis of hepatitis viruses 6.3 Morphology, pathogenicity and laboratory diagnosis of HIV / AIDS virus. 6.4 SARS 1 & 2 and H1N1	08	12
<b>Total</b>		<b>64</b>	<b>70</b>

### 8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Bacteriology I	12	06	02	02	10
II	Bacteriology II	14	06	04	02	12
III	Immunology & Serology	10	06	04	02	12
IV	Parasitology	12	06	04	02	12
V	Mycology	08	06	04	02	12
VI	Virology	08	06	04	02	12
<b>Total</b>		<b>64</b>	<b>36</b>	<b>22</b>	<b>12</b>	<b>70</b>

**Legends:** R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)

**Note:** The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

### 9. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Perform gram staining on 10 different clinical samples and report it.
- Perform AFB staining on 10 different sputum samples and report it.

### 10. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Test book of Medical Microbiology	R. Ananthanarayanan	Orient Longman, Madras
2	Microbiology	G. Guru	NCERT, New Delhi
3	A textbook of Medical Laboratory Technology	Praful Godkar	Bhalani
4	Basics of Microbiology and Hematology	Dhiraj Shekhawat	Neeraj Publishing House, New Delhi

Sr. No.	Title of Book	Author	Publication
5	A Hand book of Practical Immunology	G. P. Talwar	Vikas Publishing House
6	Medical Parasitology	D R Arora	CBS Publisher
7	Textbook of Medical Mycology	Jagdish Chander	Jaypee
8	Medical Laboratory Techniques, Vol - I, II & III	Kanai Mukharjee	McGraw Hill

### 11. SOFTWARE/LEARNING WEBSITES

- <https://paramedicsworld.com/microbiology-notes/bacteriology-notes/medical-paramedical-studynotes>
- <https://study.com/academy/topic/microbiology-basics.html>
- <https://paramedicsworld.com/microbiology-notes/mycology-notes/medical-paramedical-studynotes>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7149989/>

**PROGRAMME NAME** : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY  
**PROGRAMME CODE** : LX  
**SEMESTER** : SECOND  
**COURSE TITLE** : HISTOTECHNOLOGY AND CYTOTECHNOLOGY  
**COURSE CODE** : 28739

### 1. RATIONALE

This subject teaches the art of turning a tissue or biological samples into a glass slide that can be viewed under the microscope for diagnosis.

### 2. COMPETENCY

Student shall learn all the basic methods of histotechnology and cytotechnology to make a slide from a submitted tissue or other sample.

### 3. COURSE OUTCOMES

At the end of this unit students will understand -

- Different methods of collection of tissue and its preservation. Also understand the method and significance of decalcification.
- Know process of tissue processing and structure and working of automatic tissue processors.
- Different types of microtomes and microtome knives, and their working and maintenance.
- Basic stains in Histopathology (H&E): principle, method, utilities
- Special stains in Histopathology : principle, method, utilities
- Overall understanding of Cyto-techniques, their stains and method of staining.

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Theory						Practical					
			Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
4	--	4	08	--	--	--	--	--	--	50#\$	25	50	25	100	50

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#\$) or (@\$) : Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

**Note:** If student Remaining absent in PR-ESE shall be considered as **ABSENT** in PR-ESE

**Legends:** L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, \*#Online Examination



**5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES**

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	Preparation of 10% formalin
2	Preparation of 10% Formic acid
3	Perform decalcification of tissue
4	Detection of end point of decalcification
5	Study of different embedding media
6	Perform paraffin wax tissue processing
7	Study of embedding technique
8	Study of Rotary Microtome and its working
9	Perform Sharpening of Microtome knives
10	Study technique of section cutting- Microtomy
11	Preparation of an adhesive
12	Perform Hematoxylin and Eosin staining
13	Perform permanent mounting of section
14	Study of different samples received in cytopathology lab
15	Preparation of specimens for cytological study
16	Perform Papanicolaou (Pap) staining

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	L-Moulds and Cassetts
2	Microtome with knives
3	Tissue Processor
4	Reagents: Formalin, Nitric acid, Alcohol, Xylene, Wax
5	Koplin Jars and Slides
6	Pap Stain Kit
7	H&E staining kit
8	Paraffin Wax Bath

**7. THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours
<b>I</b>	<b>Histotechnology- Introduction, Fixatives</b> <b>Introduction</b> 1.1 Introduction & importance of histopathology and Histotechniques 1.2 Methods of specimen collection (biopsies) and examination of tissues and cells. <b>Fixatives</b> 1.3 Classification with example 1.4 Properties 1.5 Composition of different fixatives	<b>10</b>

<b>II</b>	<b>Decalcification and Tissue Processing</b> <b>2.1 Decalcification</b> Principle and Methods of Decalcification Detection of endpoint <b>2.2 Tissue Processing</b> Accession of Specimen Types of Tissue processing - Manual and Automatic Different Embedding media	<b>10</b>
<b>III</b>	<b>Tissue Processing</b> Steps of Paraffin Wax Tissue processing 3.1 Dehydration 3.2 Clearing 3.3 Impregnation 3.4 Embedding 3.5 Automatic Tissue Processor- Principle, Structure and Working	<b>10</b>
<b>IV</b>	<b>Section Cutting</b> 4.1 Microtome and microtome knives, sharpening and care 4.2 Technique of section cutting 4.3 Mounting of sections 4.4 Frozen sections and Cryostat	<b>12</b>
<b>V</b>	<b>Staining</b> 5.1 Dyes and their properties 5.2 Theory of staining 5.3 Types of staining 5.4 Basic staining – Hematoxylin and Eosin(H&E) 5.5 Mounting of sections 5.6 Common special stains PAS, Giemsa , Toluidine blue, Pruffian blue	<b>12</b>
<b>VI</b>	<b>CYTOPATHOLOGY</b> 6.1 Introduction – Cytology(Exfoliative and aspiration) and cytotechnology 6.2 Method of specimen collection and transportation for gynaecological samples 6.3 Method of specimen collection, transportation and preservation of non-gynecological samples 6.4 Fixation and its significance 6.5 Preparation of specimen for cytology 6.6 Papanicolaou Stain: Preparation, Principle, Requirements and Procedure 6.7 Rapid PAP	<b>10</b>
<b>Total</b>		<b>64</b>

### 8. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Draw Automatic tissue processor and schematically represent steps of tissue processing.
- Diagrammatically and schematically represent technique of embedding.
- Draw Rotary microtome and label its parts. Mention functions of each part.

- Schematically represent H and E staining.
- Schematically represent Papanicolaou staining.

#### 9. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Histotechnology	G. Guru	NCERT, New Delhi
2	Histological techniques: A Practical Manual	Laxminarayanan	Bhalani
3	Bancroft's Theory and Practice of Histological Techniques	John D. Bancroft	Churchill Livingstone
4	Textbook of Medical Laboratory Technology	Praful Godkar	Bhalani
5	PJ Mehta's Practical Pathology	Munjal Shah	The National Book Depot
6	Medical Laboratory Techniques, volumes 1, 2, 3	Kanai Mukherjee	McGraw Hill

#### 10. SOFTWARE/LEARNING WEBSITES

- <https://webpath.med.utah.edu/HISTHTML/HISTOTCH/HISTOTCH.html>
- <https://www.geneticistinc.com/blog/histology-emphasis-on-histotechniques>
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3507055>

**PROGRAMME NAME** : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY  
**PROGRAMME CODE** : LX  
**SEMESTER** : SECOND  
**COURSE TITLE** : ADVANCED TECHNIQUES AND FUTURE TRENDS IN LABORATORY SCIENCE  
**COURSE CODE** : 28217

### 1. RATIONALE

Science is advancing every minute. New concepts are formed; new techniques are evolved for better, accurate and precise diagnosis of diseases. Study of this subject today will make our tomorrow comfortable.

### 2. COMPETENCY

To study and gain knowledge of latest and advanced pathological techniques for precise and accurate diagnosis.

### 3. COURSE OUTCOMES

- Understanding the rapid methods, their advantages and limitations.
- Use and utility of auto analyzer, including troubleshooting of common problems
- Principle and function of cell counter, its types.
- Understanding the advanced methods for specific diagnosis
- Advances in automation in urine analysis
- Newer techniques for molecular diagnosis

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Paper Hrs.	Theory						Practical					
			ESE		PA		Total		ESE		PA		Total			
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	--	4	08	1.5	70*#	35	30*	00	100	50	50#	25	50	25	100	50

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@): Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

**Note:** If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

**Legends:** L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, \*#Online Examination



**5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES**

Sr. No.	Name of Experiment
1	Estimation of glucose with glucometer
2	Rapid method/ Tri Dot method for HIV
3	ELISA method for detection of Hepatitis B Virus
4	Automation in Biochemistry : Working of various types of Auto analyzers
5	Automation in Hematology: Working of different types of Cell counters
6	Automated blood grouping using gel cartridge method
7	Apheresis : Procedure and Applications
8	Chemiluminiscence method for serology
9	Wet and Dry Chemistry – Working principle and applications
10	Nephelometry – Working principle and applications
11	Electron Microscopy – TEM and SEM
12	Immunocytochemistry – Working principle and applications
13	Immunohistochemistry – Working Principles and Uses
14	Electrophoresis AND ITS TYPES – Principle and Application
15	Cytogenetics : FISH and karyotyping

Note : All above Practicals should be performed by visiting HiTech Pathology Laboratories attending workshops, seminars and conferences.

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	Electrophoresis Unit
2	Cell counter
3	Auto analyser
4	Glucometer
5	All rapid test kits
6	Urine dipsticks

**7. THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours	Marks
<b>I</b>	<b>Point of Care Testing ( POCT) –</b> <ul style="list-style-type: none"> <li>Urine test</li> <li>Infectious diseases- HBsAg, HIV, HCV, ROTA virus</li> <li>Glucose Estimation by Glucometer</li> <li>Cholesterol Estimation by using Cholesterol Strips</li> </ul>	<b>10</b>	<b>10</b>
<b>II</b>	<b>Biochemistry</b> <ul style="list-style-type: none"> <li>Auto analyzer – Principle &amp; Trouble shooting</li> <li>Wet and Dry Chemistry</li> <li>Chromatographic Techniques including HPLC</li> <li>Nephelometry</li> <li>ELISA, RIA, CLIA and CMIA</li> <li>Electrophoresis and Immuno fixation</li> </ul>	<b>16</b>	<b>12</b>

Unit	Topic and Contents	Hours	Marks
III	<b>Hematology</b> <ul style="list-style-type: none"> <li>Cell Counter –Principle and Trouble shooting</li> <li>Flow cytometry</li> <li>Automated blood grouping using gel cartridge method</li> <li>Apheresis</li> </ul>	10	12
IV	<b>Histotechnology &amp; Cytotechnology</b> <ul style="list-style-type: none"> <li>Immunohistochemistry</li> <li>Immunocytochemistry</li> <li>Fluorescent Microscopy</li> <li>Electron Microscopy- TEM &amp; SEM</li> <li>Cytogenetics: FISH, Karyotyping</li> </ul>	10	12
V	<b>Clinical Pathology</b> <ul style="list-style-type: none"> <li>Automated Semen Analysis, including Computer assisted semen analysis (CASA)</li> <li>Automated urine chemistry and microscopy</li> </ul>	06	12
VI	<b>Microbiology</b> <ul style="list-style-type: none"> <li>Automated microbiology cultures, identification and AST, Genxpert</li> <li>Automated mycobacterial cultures (MGIT)</li> <li>PCR and its types</li> <li>Sanger sequencing, Next-Generation Sequencing (NGS), whole genome sequencing</li> </ul>	12	12
<b>Total</b>		<b>64</b>	<b>70</b>

### 8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Point of Care Testing ( POCT)	10	02	04	04	10
II	Biochemistry	16	06	04	02	12
III	Hematology	10	06	04	02	12
IV	Histotechnology & Cytotechnology	10	06	04	02	12
V	Clinical Pathology	06	06	04	02	12
VI	Microbiology	12	06	04	02	12
<b>Total</b>		<b>64</b>	<b>32</b>	<b>24</b>	<b>14</b>	<b>70</b>

**Legends:** R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)

**Note:** The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

### 9. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Diagrammatically represent autoanalyzer.
- Diagrammatically represent Hematology cell counter.

- Schematically represent FISH technique/Flow cytometry/Chromatography/ Electrophoresis/.
- Diagrammatically represent Bactec.

#### 10. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Henry's Clinical Diagnosis & Management	McPherson & Pincus	Elsevier
2	PJ Mehta's Practical Pathology	Munjal Shah	The National Book Depot
3	Textbook of Medical Laboratory Technology	Praful Godkar	Bhalani
4	Medical Laboratory Technology	Kanai Mukherjee	McGraw Hill

#### 11. SOFTWARE/LEARNING WEBSITES

- [https://www.shimadzu.com/an/service-support/technical-support/analysis-basics/basic/what\\_is\\_hplc.html](https://www.shimadzu.com/an/service-support/technical-support/analysis-basics/basic/what_is_hplc.html)
- <https://www.cola.org/insights-newsletters/2017/summer/insights-summer-2017.pdf>
- [https://www.iitk.ac.in/che/PG\\_research\\_lab/pdf/resources/Flow-Cytometry-reading-material.pdf](https://www.iitk.ac.in/che/PG_research_lab/pdf/resources/Flow-Cytometry-reading-material.pdf)
- <https://www.ncbi.nlm.nih.gov/books/NBK92434/>



**PROGRAMME NAME : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY**

**PROGRAMME CODE : LX**

**SEMESTER : SECOND**

**COURSE TITLE : LABORATORY MANAGEMENT AND ETHICS**

**COURSE CODE : 28092**

### 1. RATIONALE

Laboratory management requires knowledge of economics, accounting, finance, operation, statistics, technology, human relations and marketing staying within the boundaries of prescribed laboratory ethics. This subject is a key for successful laboratory practice.

### 2. COMPETENCY

To acquire the background skills needed to successfully run a medical diagnostic laboratory.

### 3. COURSE OUTCOMES

- Overview of laboratory's utility in delivery of healthcare and code of ethics for lab technician
- Organizational framework of lab
- General laboratory equipments and safety measures
- Basics of medical statistics .
- Importance of quality control in laboratory
- Role of technology in delivering laboratory service

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
			Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	--	2	6	1.5	--	--	--	--	--	--	50#\$	25	50	25	100	50

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#\$) or (@\$) : Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

**Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE**

**Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment**

@Internal Assessment, #External Assessment, \*#Online Examination



**5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES**

Sr. No.	Name of Practical/ Exercise/ Assignment/ Case Study
1	First aid for chemical burns, poisonous gases, Electrical Shock and Glass injuries
2	Use of bandages, splints and demonstration of Cardio- pulmonary resuscitation, external cardiac massage
3	Use of Windows Utilities – Explorer, Setting etc.
4	File operation – Copy, Move, Delete, Rename etc
5	Document Creation, editing, printing using MSWord
6	Spreadsheets / charts, editing, printing, using MS Excel
7	Power point presentation, editing and creation using MS power point
8	Calculation of mean, median, mode, standard deviation and coefficient of variation
9	Application of Westgard rules
10	Practice of a mock quality audit

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

Sr. No.	Equipment Name with Broad Specifications
1	First Aid kit
2	Different glassware
3	Desktop Computer

**7. THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

Unit	Topic and Contents	Hours
<b>I</b>	<b>Laboratory</b> 1.1 Laboratory at different level (National / State /District) 1.2 Duties and responsibilities of laboratory personnel 1.3 Laboratory services are a backbone of health care delivery system. 1.4 Code of Ethics for Laboratory Technician	<b>08</b>
<b>II</b>	<b>Laboratory Planning</b> 2.1 General principles 2.2 Laboratory goals 2.3 Operational data– <ul style="list-style-type: none"> <li>• Market potential,</li> <li>• Selection of area,</li> <li>• <b>Competition,</b></li> <li>• Laboratory trends,</li> <li>• Space requirements,</li> <li>• Designing of laboratory sections,</li> <li>• Staff and their duties,</li> <li>• Work schedule and workload assessment</li> </ul>	<b>10</b>
<b>III</b>	<b>Care Of Laboratory Glassware, Chemicals Equipment And Instruments</b> 3.1 General Principles	<b>12</b>



Unit	Topic and Contents	Hours
	3.2 Care and Cleaning of Glassware 3.3 Laboratory chemicals – Proper use, care, storage and labelling 3.4 Specimen handling <ul style="list-style-type: none"> <li>• Appropriate container</li> <li>• Method of collection</li> <li>• Method of transportation</li> <li>• Method of preservation and disposal of laboratory waste</li> </ul> 3.5 Biomedical Waste Management – 2016 guidelines	
IV	<b>Laboratory Safety and Quality control in laboratory medicine</b> <ul style="list-style-type: none"> <li>• General principles of safety programs</li> <li>• First aid and safety measures for Mechanical, Electrical, Chemical, radioactive and Biological hazards</li> <li>• Universal safety precautions- Eye wash, spill kit, needle stick injury</li> <li>• Quality control in laboratory medicine</li> </ul> Biostatistics: Mean, Median, Mode, Standard Deviation, Coefficient of Variation. Internal and External Quality Control Levey Jennings Chart and application of Westgard rules.	12
V	<b>Quality control in laboratory medicine</b> 5.1 Quality control and quality assurance in following sections of laboratory <ul style="list-style-type: none"> <li>• Biochemistry,</li> <li>• Microbiology,</li> <li>• Haematology and Blood Banking</li> <li>• Histopathology and Clinical Pathology</li> </ul> 5.2 Accreditation and Quality certification of Medical Laboratories: QCI, NABL, NABH, ISO 5.3 Concept of reference range and national and international guidelines governing the same.	08
VI	<b>Application Of Computers In Laboratory Practice</b> 6.1 Introduction to Computers <ul style="list-style-type: none"> <li>• Block diagram</li> <li>• Input and Output devices</li> <li>• Storage devices</li> </ul> 6.2 Introduction to operating systems <ul style="list-style-type: none"> <li>• Need of Operating systems(OS)</li> <li>• Function of OS</li> <li>• Windows 10 – Utilities and basic operations</li> <li>• Microsoft office 365 – MS Word, MS Excel, MS Power point</li> <li>• LIMS, barcoding and total automation in medical laboratories.</li> <li>• Net surfing and email</li> </ul>	14
<b>Total</b>		64



**8. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

- Diagrammatically show different sections of pathology laboratory.
- Diagrammatically show different sections of Blood bank.

**9. SUGGESTED LEARNING RESOURCES**

Sr. No.	Title of Book	Author	Publication
1	Clinical Laboratory Management	Eleanor M. Travers	Williams & Wilkens
2	Laboratory Setup & Procedures	G. Guru	NCERT, New Delhi
3	Medical Laboratory Technology Vol 1, 2, 3	Kanai Mukherjee	McGraw Hill
4	PJ Mehta's Practical Pathology	Munjil Shah	The National Book Depot
5	Biosafety Manual for Laboratories	WHO	WHO Publication, Geneva
6	Textbook of Medical Laboratory Technology	Praful Godkar	Bhalani

**10. SOFTWARE/LEARNING WEBSITES**

- [https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture\\_notes/med\\_lab\\_tech\\_students/medicallabtechnology.pdf](https://www.cartercenter.org/resources/pdfs/health/ephti/library/lecture_notes/med_lab_tech_students/medicallabtechnology.pdf)
- <https://www.iuokada.edu.ng/wp-content/uploads/2020/01/ETHICS-IN-LABORATORY-TECHNIQUES-and-MANAGEMENT-Prof-Aziba.pdf>

**PROGRAMME NAME** : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

**PROGRAMME CODE** : LX

**SEMESTER** : THIRD

**COURSE TITLE** : PROJECT

**COURSE CODE** : 28726

### 1. RATIONALE

The main aim of the preparation of project is to judge the knowledge gained by the students during their tenure of the programme, the transfer of learning to useful socially relevant application. This will also help in various skills such as Personal, social, professional and lifelong learning. The students will be benefited lot by this exercise of preparation of project on their experiences which will certainly add values in their attitudes such as value for health, work commitment, hardworking, honesty, problem solving, punctuality, loyalty and independent study. The Student should also make a brief presentation about the project and the salient observations and findings.

### 2. COMPETENCY

This will develop various skills such as Personal, social, professional and lifelong learning. The students will be benefited lot by this exercise of preparation of project on their experiences which will certainly add values in their attitudes such as value for health, work commitment, hardworking, honesty, problem solving, and punctuality, loyalty and independent study.

### 3. COURSE OUTCOMES

The student will be able to

- To work in various pathological and clinical activities conducted in hospitals and laboratories.
- Keep day-to-day record of the actual work done in hospital/health care Industries/Pathological laboratories.
- Collection of various related information about the pathological examinations in hospitals

### 4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit	Examination Scheme													
L	T	P	(L+T+P)	Theory						Practical							
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total		
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	10	10	--	--	--	--	--	--	--	--	50#	25	50	25	100	50

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@): Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical - ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment



@Internal Assessment, #External Assessment, \*#Online Examination

## 5. IMPLEMENTATION STRATEGY

Candidate should be assigned Project preferably individually or if at all not possible can form a group of maximum 3 members. Every candidate must maintain the weekly progress diary and the guide should review the progress and sign the diary regularly.

Every candidate has to submit **Synopsis Report** (of pages not more than 10) and deliver Two Presentations for the completion of the Project.

**First Presentation of Synopsis** - to the Internal Guide tentatively during Third Week of the Academic Term.

**Second Presentation on complete Project** - to be given to the Internal Guide during Second Class Test schedule.

**Contents of the Synopsis** - It should include the following points

1. Cover Page of the Synopsis (Title of the Project, Student and Guide Details, Institute Name, Academic Year, Maharashtra State Board of Technical Education, Mumbai)
2. Index
3. Introduction
4. Need of the Project and Objectives
5. Problem Definition
6. Methodology
7. Action Plan

Evaluation of Practical-PA will be the average of two presentations, synopsis report and weekly progress diary maintained by the candidate.

There should not be any sort of typographical, diagrammatic and any other mistake/s in the final bound copy of the project report submitted by the candidate.

## PROJECT REPORT CONTENTS

The Project report should essentially consists of the following details.

- COVER PAGE OF THE PROJECT
- CERTIFICATE FROM THE INSTITUTE
- ACKNOWLEDGEMENT
- TABLE OF CONTENTS
- ABSTRACT
- INTRODUCTION
- METHODOLOGY OF PROJECT
- RESULTS
- CONCLUSION AND FUTURE SCOPE
- ABOUT THE ORGANISATION / COMPANY (IN CASE OF INDUSTRY BASED PROJECTS)



- REFERENCES / BIBLIOGRAPHY

**GUIDELINES FOR PREPARING THE PROJECT REPORT**

Project work is a basic requirement for the award of Advanced Diploma. Project should be prepared based on any one of the subjects of the Programme. The project work should be comprehensive and cover all aspects of the management.

**COVER PAGE OF THE PROJECT**

The Cover Page of the Project Report must include Title of the Project, Student and Guide Details, Institute Name, Academic Year, Maharashtra State Board of Technical Education, Mumbai.

**CERTIFICATE FROM THE INSTITUTE**

Certification from Project Guide, HOD, Principal and signature of external examiner during final examination.

**ACKNOWLEDGEMENT**

It should appear on the third page and the report writer should acknowledge the guidance provided by the project guide. Here the author may also acknowledge other persons who might have rendered help or supplied the required data or information for completion of the project. It should be brief and crisp. Generally, one page should suffice for acknowledgement.

**TABLE OF CONTENTS**

It must consist Chapter No., Name of the Chapter and Page Number.

**ABSTRACT**

Abstract should describe the entire project work with its aim, objectives and methodology and conclusion. The abstract should be limited to one or two pages.

**INTRODUCTION**

Give brief description of need, significance and applications of the Project. It is recommended to limit the description to about 2 to 5 pages.

**METHODOLOGY OF PROJECT**

This is the most important part of the project and forms the main body of the project report. It needs very comprehensive coverage of all aspects.

It will be prudent to mention the methodology used for the project work, e.g., collecting information of various types of equipment/components, questionnaires, detailed study, working principle, operations, block diagram, structure, material used for designing of technical specifications, results etc. thereafter, detail procedure to achieve the project output.



## RESULT

It should content the experimentation results of the project.

## CONCLUSION AND FUTURE SCOPE

Based on the project work, draw inferences, and mention future scope. The future scope should be specific, relevant and practically implementable.

## ABOUT THE ORGANISATION / COMPANY (IN CASE OF INDUSTRY BASED PROJECTS)

Should mention organizational structure, product / services (limit 1 or 2 pages).

## REFERENCES / BIBLIOGRAPHY

Mentions books, research papers, web sites referred in the report and in this section.

## PROJECT REPORT FORMAT

- Paper Size - A4
- Printing - Only on one side of the sheet
- Line Spacing of Paragraph - 1 ½
- Font Face - Times New Roman
- Font Size - 12 for Normal text, 14 for Sub-headings and 16 for Headings
- No of Project Report copies - Two
- Binding - Hard bound copies with Black cover (Golden Embossing)



**PROGRAMME NAME** : ADVANCED DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY  
**PROGRAMME CODE** : LX  
**SEMESTER** : THIRD  
**COURSE TITLE** : HOSPITAL TRAINING / PATHOLOGY LABORATORY TRAINING  
**COURSE CODE** : 28727

### 1. RATIONALE

Hospital training course is introduced to advanced diploma programmes with the aim to imbibe in the students the professional practices before they enter into actual world of diagnostics. By exposing and interacting with the real life pathology laboratory setting, student will appreciate and understand the actual working of hospital laboratories, best practices adopted and other requirements needed to work in the laboratory. The needs such as the soft skills, life skills and hands-on practices are intended to be inculcated in the students through this training. This short association with the hospitals or Pathology Laboratories will be instrumental in orienting the students in transforming them to be market ready after completion of Advance diploma programme.

### 2. COMPETENCY

This course is intended to develop the following competencies:

- Soft Skills i.e. Communication, Presentation and dealing with patients.
- Life Skills i.e. Time management, Safety precautions, Entrepreneurship, Team building and others
- Hands-on Practices i.e. Performing routine diagnostic tests and Quality Assurance aspects.

### 3. COURSE OUTCOMES

The Hospital or Pathology training is intended to acquire the competencies as mentioned above to supplement those attained through previous two semester of the program:

- Communicate effectively (verbal as well as written) to execute the work.
- Prepare the Hospital training report of the executed work.
- Exercise time management and safety in the work environment.
- Understanding the Hospital or Pathology laboratory set up and its functioning.

### 4. SUGGESTED TEACHING & EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme											
L	T	P		Paper Hrs.	Theory						Practical				
			ESE		PA		Total		ESE		PA		Total		
Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
-	-	20	20	--	--	--	--	--	--	100#	50	100	50	200	100

(\*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@): Under the practical ESE - 50 Marks (100%)  
 1) 30 Marks (60%) - For Practical - ESE



2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

**Note:** If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

**Legends:** L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, \*#Online Examination

## 5. GENERAL GUIDELINES FOR HOSPITAL OR PATHOLOGY LABORATORY TRAINING

The Hospitals or pathology Laboratories can be Government/Private/Corporate/

- **Duration of Industrial Training:** 8 weeks in Final Semester as per the credits of the programme.
- **Training Area:** Students should be trained in well-equipped hospital laboratories. Organization should try to collaborate with some reputed hospitals/ pathology laboratories or diagnostic centres by signing a Memorandum of Understanding. However, despite the best efforts by the institute, if it is not possible then students can also be placed in small pathology laboratories.
- **Skill Knowledge Partner :** To be identified by the Institute as per their programme areas
  1. Diagnostic Centers
  2. Hospitals
  3. Healthcare Centers

## 6. EXPECTATIONS FROM Skill Knowledge Partner(SKP)

Helping institute in developing the following competencies among students

- Soft Skills i.e. Communication, Presentation and others.
- Life Skills i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others
- Hands-on Practices i.e. Shop floor Implementation and Quality Assurance aspects.

## 7. ROLE OF PARENT DEPARTMENT OF THE INSTITUTE

- Collecting information about Industry / Organization available for training along with capacity.
- Institutions have to enter in to MOU with number of SKPs ( Industries/ Organizations) for accommodating all the enrolled students for the mandatory
- Student and mentor allocation as per the slots available for in-plant training (Desirable mentor- student ratio is 1:15).
- Communication with Industry / Organization available for training along with capacity and its confirmation.
- Student enrollment for training.
- Issuing letter to the Industry / Organization for the training along with details of students and mentors.



- Principal/ HOD/ Faculty should address students about industrial safety norms, rules and discipline to be maintained in the Industry/ Organization during the training before relieving students for training.
- The faculty member during the visit to Industry/ Organization will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.
- Mentors to carry out progressive assessment of the students during the training through Progressive Assessment (PA).
- End Semester Examination (ESE) assessment by mentor along with Industry / Organization expert as external examiner

## 8. ROLES AND RESPONSIBILITIES OF THE STUDENTS

Following should be informed to students in the letter deputing them for the training, an undertaking for this should also be taken from them

- Students would interact with the mentor to suggest choices for suitable Industry / Organization. If students have any contact in Industry / Organization (through their parents, relatives or friends) then same may be utilized for securing placement for themselves and their peers.
- Students have to fill the forms duly signed by authorities along with training letter and submit it to training officer in the industry on the first day of training. Student should also carry with him/her the Identity card issued by institute during training period.
- He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the Industry / Organization and safety procedures to be followed. Student is expected to observe these rules, regulations, procedures.
- Students should know that if they break any rule of industry or do not follow the discipline then industry can terminate the training and send back the student.
- It is the responsibility of the student to collect information from Industry / Organization about quality assurance methods/specifications of machines and raw materials/maintenance procedures/ production planning/work ethics/professional practices/organizational structure etc.
- During the training period students have to keep daily record of all the useful information in Log book
- Maintain the Diary/Logbook and get it signed from mentor as well as Industry / Organization Training in-charge.
- In case they face any major problem in industry such as an accident or any disciplinary issue then they should immediately report the same to the institute.
- Prepare final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from mentor as well as Industry / Organization training in-charge.

## 9. FORMAT FOR TRAINING REPORT

Following is the suggestive format for the training report, actual format may differ slightly depending upon the nature of Industry / Organisation. The training report may contain the



following

- Title page
- Certificate
- Abstract
- Acknowledgement
- Content Page

- Chapter 1. Organizational structure of Industry / Organisation and General Lay Out
- Chapter 2. Introduction of Industry / Organisation (Type of products and services, history, turn over and number of employees etc.)
- Chapter 3. Types of major equipment/instruments/ machines used in Industry/ Organization with their specification, approximate cost and specific use and their routine maintenance.
- Chapter 4. Manufacturing Processes along with production planning and control methods and standard Operating procedures.
- Chapter 5. Testing of raw materials, components and finished products along with quality assurance procedures.
- Chapter 6. Major material handling product and procedures.
- Chapter 7. Safety procedures followed
- Chapter 8. Particulars of Practical Experiences in Industry / Organisation if any in Production/ Assembly/ Testing/Maintenance.
- Chapter 9. Short report/description of the project (if any done during the training)
- Chapter 10. Special/challenging experiences encountered during training if any (may include students liking & disliking of work places)
- References /Bibliography

## 10. SUGGESTED LEARNING STRATEGIES

Students should visit the website of the industry/Private firm where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc. They should also refer the handbooks of the major machines and operation, testing, quality control and standard operating procedures and practices used in the industry. Students may also visit websites related to other similar industries as their learning resource. The training activity may vary according to nature and size of Industry / Organization. The details of activities to be completed during 8 weeks should be planned appropriately. The evaluation of Industrial training will be done on the basis of skills acquired by the student during this 8 weeks period.



**ASSESSMENT SCHEME FOR HOSPITAL TRAINING / PATHOLOGY LABORATORY**

Training duration	PROGRESSIVE ASSESSMENT (Weekly report of all 8 week and attendance)		END SEMESTER ASSESSMENT (Seminar and Oral )		Total marks	
	Max. marks	Min. marks	Max. marks	Min. marks	Max. marks	Min. marks
Eight Weeks	100	50	100	50	200	100

**EVALUATION SHEET FOR PA OF HOSPITAL TRAINING / PATHOLOGY LABORATORY**

Sr. No.	Enrollment Number	Name of Student	Marks by Mentor & Industry Supervisor jointly	Marks by Industry Supervisor	Marks by Mentor Faculty	Total Marks
			Out of 40 (A)	Out of 30 (B)	Out of 30 (C)	Out of 100 (A+B+C)

**DISTRIBUTION OF END-SEMESTER-EXAMINATION (ESE) MARKS OF HOSPITAL TRAINING / PATHOLOGY LABORATORY**

Marks for Industrial Training Report	Marks for Seminar/ Presentation	Marks for Oral/Viva-voce	Total ESE marks
25	25	50	100

