Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name : Diploma In Medical Laboratory Technology

Programme Code : ML | **With Effect From Academic Year** : 2023-24

Duration Of Programme : 6 Semester | **Duration** : 16 WEEKS

Semester : Fourth | **NCrF Entry Level : 3.5** | **Scheme** : K

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																								
1	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	314301	2	3	-	-	1	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125
2	CLINICAL BIOCHEMISTRY	CLB	DSC	324315	-	3	-	4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
3	HEMATOLOGY	HEM	DSC	324316	-	3	-	4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175
4	MEDICAL BACTERIOLOGY	MBA	DSC	324317	-	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175
5	HISTOTECHNIQUE	HIS	SEC	324012	-	1	-	4	1	6	3	-	-	-	-	-	50	20	25@	10	25	10	100
6	LABORATORY MANAGEMENT AND ETHICS	LME	SEC	324013	2	1	-	4	1	6	3	-	-	-	-	-	50	20	25@	10	25	10	100
Total					**4**	**14**		**20**	**6**		**20**		**120**	**280**	**400**		**175**		**125**		**150**		**850**

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

Course Category : Discipline Specific Course Core (DSC) , Discipline Specific Elective (DSE) , Value Education Course (VEC) , Intern./Apprenti./Project./Community (INP) , AbilityEnhancement Course (AEC) , Skill Enhancement Course (SEC) , GenericElective (GE)

Programme Name/s	**: Architecture Assistantship/ Architecture and Interior Design/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Software Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Manufacturing Technology/ Medical Electronics/ Metallurgical Engineering/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Computer Science/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AD/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CST/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MRT/ MU/ MY/ PG/ PN/ PO/ SC/ SE/ TC/ TE/ TR/ TX**
Semester	**: Fourth / Sixth**
Course Title	**: ENVIRONMENTAL EDUCATION AND SUSTAINABILITY**
Course Code	**: 314301**

I. RATIONALE

The survival of human beings is solely depending upon the nature. Thus, threats to the environment directly impact on existence and health of humans as well as other species. Depletion of natural resources and degradation of ecosystems is accelerated due to the growth in industrial development, population growth, and overall growth in production demand. To address these environmental issues, awareness and participation of individuals as well as society is necessary. Environmental education and sustainability provide an integrated, and interdisciplinary approach to study the environmental systems and sustainability approach to the diploma engineers.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Resolve the relevant environmental issue through sustainable solutions

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify the relevant Environmental issues in specified locality.
- CO2 - Provide the green solution to the relevant environmental problems.
- CO3 - Conduct SWOT analysis of biodiversity hotspot
- CO4 - Apply the relevant measures to mitigate the environmental pollution.
- CO5 - Implement the environmental policies under the relevant legal framework.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
314301	ENVIRONMENTAL EDUCATION AND SUSTAINABILITY	EES	VEC	3	-	-	1	4	2	1.5	30	70*#	100	40	-	-	-	-	25	10	125

Total IKS Hrs for Sem. : 2 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.

ENVIRONMENTAL EDUCATION AND SUSTAINABILITY **Course Code : 314301**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the need of studying environment and its components. TLO 1.2 Investigate the impact of population growth and industrialization on the relevant environmental issues and suggest remedial solutions TLO 1.3 Explain the Concept of 5 R w.r.t. the given situation TLO 1.4 Elaborate the relevance of Sustainable Development Goals in managing the climate change TLO 1.5 Explain the concept of zero carbon-footprint with carbon credit	**Unit - I Environment and climate change** 1.1 Environment and its components, Types of Environments, Need of environmental studies 1.2 Environmental Issues- Climate change, Global warming, Acid rain, Ozone layer depletion, nuclear accidents. Effect of population growth and industrialization 1.3 Concept of 5R, Individuals' participation in i) 5R policy, ii) segregation of waste, and iii) creating manure from domestic waste 1.4 Impact of Climate change, Factors contributing to climate change, Concept of Sustainable development, Sustainable development Goals (SDGs), Action Plan on Climate Change in Indian perspectives 1.5 Zero Carbon footprint for sustainable development, (IKS-Enviornment conservation in vedic and pre-vedic India)	Lecture Using Chalk-Board Presentations
2	TLO 2.1 Justify the importance of natural resources in sustainable development TLO 2.2 Explain the need of optimum use of natural resources to maintain the sustainability TLO 2.3 Differentiate between renewable and non-renewable sources of energy TLO 2.4 Suggest the relevant type of energy source as a green solution to environmental issues	**Unit - II Sustainability and Renewable Resources** 2.1 Natural Resources: Types, importance, Causes and effects of depletion. (Forest Resources, Water Resources, Energy Resources, Land resources, Mineral resources), (IKS-Concepts of Panchmahabhuta) 2.2 Impact of overexploitation of natural resources on the environment, optimum use of natural resources 2.3 Energy forms (Renewable and non-renewable) such as Thermal energy, nuclear energy, Solar energy, Wind energy, Geothermal energy, Biomass energy, Hydropower energy, biofuel 2.4 Green Solutions in the form of New Energy Sources such as Hydrogen energy, Ocean energy & Tidal energy	Lecture Using Chalk-Board Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain the characteristics and functions of ecosystem TLO 3.2 Relate the importance of biodiversity and its loss in the environmental sustainability TLO 3.3 Describe biodiversity assessment initiatives in India TLO 3.4 Conduct the SWOT analysis of the biodiversity hot spot in India TLO 3.5 Explain the need of conservation of biodiversity in the given situation	**Unit - III Ecosystem and Biodiversity** 3.1 Ecosystem - Definition, Aspects of ecosystem, Division of ecosystem, General characteristics of ecosystem, Functions of ecosystem 3.2 Biodiversity - Definitions, Levels, Value, and loss of biodiversity 3.3 Biodiversity Assessment Initiatives in India 3.4 SWOT analysis of biodiversity hot spot in India 3.5 Conservations of biodiversity - objects, and laws for conservation of biodiversity	Lecture Using Chalk-Board Presentations Video Demonstrations
4	TLO 4.1 Classify the pollution based on the given criteria TLO 4.2 Justify the need of preserving soil as a resource along with the preservation techniques TLO 4.3 Maintain the quality of water in the given location using relevant preventive measures TLO 4.4 State the significance of controlling the air pollution to maintain its ambient quality norms TLO 4.5 Compare the noise level from different zones of city with justification TLO 4.6 Describe the roles and responsibilities of central and state pollution control board	**Unit - IV Environmental Pollution** 4.1 Definition of pollution, types- Natural & Artificial (Man- made) 4.2 Soil / Land Pollution – Need of preservation of soil resource, Causes and effects on environment and lives, preventive measures, Soil conservation 4.3 Water Pollution - sources of water pollution, effects on environment and lives, preventive measures, BIS water quality standards for domestic potable water, water conservation 4.4 Air pollution - Causes, effects, prevention, CPCB norms of ambient air quality in residential area 4.5 Noise pollution - Sources, effects, prevention, noise levels at various zones of the city 4.6 Pollution Control Boards at Central and State Government level: Norms, Roles and Responsibilities	Lecture Using Chalk-Board Presentations
5	TLO 5.1 Explain Constitutional provisions related to environmental protection TLO 5.2 Explain importance of public participation (PPP) in enacting the relevant laws TLO 5.3 Use the relevant green technologies to provide sustainable solutions of an environmental problem TLO 5.4 Explain the role of information technology in environment protection	**Unit - V Enviornmental legislation and sustainable practices** 5.1 Article (48-A) and (51-A (g)) of Indian Constitution regarding environment, Environmental protection and prevention acts 5.2 Public awareness about environment. Need of public awareness and individuals' participation. Role of NGOs 5.3 Green technologies like solar desalination, green architecture, vertical farming and hydroponics, electric vehicles, plant-based packaging 5.4 Role of information technology in environment protection and human health	Lecture Using Chalk-Board Presentations Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

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Suggest the steps to implement (or improve the implementation) of the 5R policy in your home/institute stating your contribution
Draft an article on India's Strategies to progress across the Sustainable Development Goals
Make a chart of Renewable and non-renewable energy sources mentioning the advantages and disadvantages of each source
Conduct the SWOT analysis of biodiversity hotspot in India
Prepare a mind-mapping for the zero carbon footprint process of your field
Prepare a chart showing sources of pollution (air/water/ soil), its effect on human beings, and remedial actions
Any other assignment on relevant topic related to the course suggested by the facilitator

UNICEF Certification(s)

- Students may complete the self-paced course launched by Youth Leadership for climate Exchange under UNICEF program on portal www.mahayouthnet.in . The course encompasses five Modules in the form of Units as given below: -

Unit 1: Living with climate change
Unit 2 : Water Management and Climate Action
Unit 3: Energy Management and Climate Action
Unit 4 : Waste Management and Climate Action
Unit 5 : Bio-cultural Diversity and Climate Action
If students complete all the five Units they are not required to undertake any other assignment /Microproject/activities specified in the course. These units will suffice to their evaluations under SLA component

Micro project

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Technical analysis of nearby commercial RO plant.
Comparative study of different filters used in Household water filtration unit
Evaluate any nearby biogas plant / vermicomposting plant or any such composting unit on the basis of sustainabilityand cost-benefit
IKS-Study and prepare a note on Vedic and Pre-Vedic techniques of environmental conversion
Visit a local polluted water source and make a report mentioning causes of pollution
Any other activity / relevant topic related to the course suggested by the facilitator

Activities

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Prepare a report on the working and functions of the PUC Center machines and its relavance in pollution control.
Prepare and analyse a case study on any polluted city of India
Prepare a note based on the field visit to the solid waste management department of the municipal corporation / local authority

Record the biodiversity of your institute/garden in your city mentioning types of vegetation and their numbers
Visit any functional hall/cultural hall /community hall to study the disposal techniques of kitchen waste and prepare a report suggesting sustainable waste management tool
Watch a video related to air pollution in India and present the summary
Any other assignment on relevant topic related to the course suggested by the facilitator

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Nil	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Environment and climate change	CO1	8	4	4	4	12
2	II	Sustainability and Renewable Resources	CO2	10	4	4	8	16
3	III	Ecosystem and Biodiversity	CO3	8	4	4	4	12
4	IV	Environmental Pollution	CO4	12	4	8	6	18
5	V	Enviornmental legislation and sustainable practices	CO5	7	4	4	4	12
Grand Total				**45**	**20**	**24**	**26**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two-unit tests (MCQs) of 30 marks will be conducted and average of two-unit tests considered. Formative assessment of self learning of 25 marks should be assessed based on self learning activity such as UNICEF Certification(s)/Microproject/assignment/activities. (60 % weightage to process and 40 % to product)

Summative Assessment (Assessment of Learning)

- Online MCQ type Exam

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	-	1	-	-	3	2	3			
CO2	-	2	2	-	3	2	3			
CO3	-	-	-	-	3	1	2			
CO4	1	-	-	-	3	2	2			
CO5	1	-	2	-	3	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Y. K. Singh	Environmental Science	New Age International Publishers, 2006, ISBN: 81-224-2330-2
2	Erach Bharucha	Environmental Studies	University Grants Commission, New Delhi
3	Rajagopalan R.	Environmental Studies: From Crisis to Cure.	Oxford University Press, USA, ISBN: 9780199459759, 0199459754
4	Shashi Chawla	A text book of Environmental Science	Tata Mc Graw-Hill New Delhi
5	Arvind Kumar	A Text Book of Enviornmental science	APH Publishing New Delhi (ISBN 978-8176485906)

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://sdgs.un.org/goals	United Nation’s website mentioning Sustainability goals
2	http://www.greenbeltmovement.org/news-and-events/blog	Green Belt Movement Blogs on various climatic changes and other issues
3	http://www.greenbeltmovement.org/what-we-do/tree-planting-fo r-watersheds	Green Belt Movement's work on tree plantation, soil conservation and watershed management techniques

Sr.No	Link / Portal	Description
4	https://www.youtube.com/@ierekcompany/videos	International Experts For Research Enrichment and Knowledge Exchange – IEREK's platform to exchange the knowledge in fields such as architecture, urban planning, sustainability
5	www.mahayouthnet.in	UNICEF Intiative for youth leadership for climate action
6	https://eepmoefcc.nic.in/index1.aspx?lsid=297&lev=2&lid=1180&langid=1	GOI Website for public awareness on enviornmetal issues
7	https://egyankosh.ac.in/handle/123456789/61136	IGNOU's Intiative for online study material on Enviornmental studies
8	https://egyankosh.ac.in/handle/123456789/50898	IGNOU's Intiative for online study material on sustainability
9	https://sustainabledevelopment.un.org/content/documents/11803Official-List-of-Proposed-SDG-Indicators.pdf	Final list of proposed Sustainable Development Goal indicators
10	https://sustainabledevelopment.un.org/memberstates/india	India’s Strategies to progress across the SDGs.
11	https://www.un.org/en/development/desa/financial-crisis/sustainable-development.html	Challenges to Sustainable Development
12	https://nptel.ac.in/courses/109105190	NPTEL course on sustainable development
13	https://onlinecourses.swayam2.ac.in/cec19_bt03/preview	Swayam Course on Enviornmetal studies (Natural Resources, Biodiversity and other topics)
14	https://onlinecourses.nptel.ac.in/noc23_hs155/preview	NPTEL course on enviornmental studies which encomopasses SDGs, Pollution, Cliamate issues, Energy, Policies and legal framework
15	https://www.cbd.int/development/meetings/egmbped/SWOT-analysis-en.pdf	SWOT analysis of Biodiversity
16	https://www.sanskrit.nic.in/SVimarsha/V2/c17.pdf	Central sanskrkit university publication on Vedic and pre vedic enviornmetal conservation

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

CLINICAL BIOCHEMISTRY **Course Code : 324315**

Programme Name/s : Medical Laboratory Technology
Programme Code : ML
Semester : Fourth
Course Title : CLINICAL BIOCHEMISTRY
Course Code : 324315

I. RATIONALE

Clinical biochemistry is the branch of laboratory medicine that deals with the measurement of chemicals and biochemical compounds in bodily fluids. Skills in this field are essential in the diagnosis, monitoring, and treatment of various diseases. Biochemical markers, also known as biomarkers, are substances found in the body that can indicate the presence of a particular disease or condition. These markers are typically measured in blood, urine, or other bodily fluids and can provide important information about a person's health status .

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Analyze Various body fluids using relevant procedure in order to correlate the result with different diseases.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Interpret the metabolic process in given cell structure
- CO2 - Analyze biomolecule in body fluid.
- CO3 - Perform liver function test to identify correlation of findings with disease.
- CO4 - Identify the relevant biochemical parameters to detect abnormality in heart function.
- CO5 - Perform endocrine function test to detect harmonal dysfunction related to diseases of endocrine.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324315	CLINICAL BIOCHEMISTRY	CLB	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Sem. : Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

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2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe glycolysis, glucogenesis and Kerb's Cycle in detail. TLO 1.2 Describe the process of blood sugar regulation to maintain a healthy body. TLO 1.3 Explain the condition of Glycosylated hemoglobin with reference to various abnormilities. TLO 1.4 Justify importance of urea level with reference to Urea Cycle. TLO 1.5 Justify importance of monitoring nitrogenous constituent in blood.	**Unit - I Carbohydrate and Protein Metabolism** 1.1 Glycolysis, Glucogenesis and Kreb's Cycle. 1.2 Sources of blood sugar, Normal blood sugar level and its regulation in body. 1.3 Causes of abnormalities- hyperglycemia, hypoglycemia, Glycosuria and Glycosylated hemoglobin. 1.4 Transamination, deamination and Urea Cycle in body 1.5 Nitrogenous constituent in blood (Protein and Non-Protein) and associated effects	Video Demonstrations Case Study Presentations Group Discussion Flipped Classroom
2	TLO 2.1 Describe beta oxidation and ketone bodies formation and excretion. TLO 2.2 Justify Importance of maintaining normal value of plasma lipids. TLO 2.3 Classify lipoproteins TLO 2.4 Justify Importance of maintaining normal Value of sodium and Potassium TLO 2.5 Justify Importance of maintaining normal Value of PH in Blood PH.	**Unit - II Lipids and Minerals Metabolism** 2.1 Beta Oxidation of fatty acid and ketone bodies formation. 2.2 Plasma lipid and their normal value, Cholesterolemia and atherosclerosis. 2.3 Classification of lipoprotein. 2.4 Sources, daily requirement, blood level, function and abnormalities of Sodium and Potassium. 2.5 Blood PH- Definition, regulation and abnormalities (Acidosis and alkalosis)	Flipped Classroom Video Demonstrations Case Study Presentations Collaborative learning

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Describe process of bilirubin formation and excretion. TLO 3.2 Differentiate different type of jaundice TLO 3.3 Explain Bilirubinuria. TLO 3.4 Describe the procedure and clinical interpretation of GTT. TLO 3.5 Describe the procedure and clinical interpretation of bilirubin estimation.	**Unit - III Hepatic Function Test** 3.1 Bilirubin formation and excretion. 3.2 Classification of Jaundice. 3.3 Condition of Bilirubinuria 3.4 Liver function test bases on metabolic function e.g. Galactose tolerance test 3.5 Liver function test bases on excretory function e.g. Bilirubin estimation	Video Demonstrations Flipped Classroom Case Study Presentations Group discussion
4	TLO 4.1 Explain the structure and working of healthy human heart TLO 4.2 Explain the condition of Myocardial infarction. TLO 4.3 Describe stepwise procedure of serum lipid profile test for specified sample. TLO 4.4 Describe stepwise procedure of SGPT, LDH test for specified sample. TLO 4.5 Describe cardiac marker released during cardiac injury.	**Unit - IV Cardiac Profile Test** 4.1 Structure of heart and its working. 4.2 Ischemic heart disease and Myocardial infarction 4.3 Cardiac risk evaluation test e.g. Serum lipid profile and Homocysteine 4.4 Cardiac injury panel test e.g. CKMB, SGPT, LDH 4.5 Cardiac markers e.g. Myoglobin, Tropine I and T, BNP and Pro BNP and hs-CRP	Model Demonstration Video Demonstrations Presentations Flipped Classroom Case Study
5	TLO 5.1 Explain the kidney function test. TLO 5.2 Describe creatinine test of different types for detecting condition of kidney function. TLO 5.3 Explain procedure of routine Urine Analysis. TLO 5.4 Describe the procedure of Thyroid Function Test. TLO 5.5 Describe procedure of pregnancy test.	**Unit - V Kidney and endocrine and Function Test.** 5.1 Specific gravity, Osmolarity by Urinometer. 5.2 Need of creatinine test, Procedure of Creatinine Clearance test and its types. 5.3 Routine Urine analysis- parameters and process 5.4 Thyroid Function tests- ELISA etc. 5.5 VMA estimation in urine and their significance, pregnancy test	Video Demonstrations Flipped Classroom Case Study Simulation Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Examine blood sugar by glucometer.	1	*Estimation of blood sugar by glucometer.	4	CO1
LLO 2.1 Assess glycosylated hemoglobin in blood.	2	*Estimation of glycosylated hemoglobin in blood.	4	CO1
LLO 3.1 Determine Albumin/Globulin ratio by biuret method.	3	*Estimation of Albumin/Globulin ratio by biuret method.	4	CO1
LLO 4.1 Estimate total calcium in serum.	4	*Estimation of total calcium in serum.	4	CO2
LLO 5.1 Estimate total cholesterol in serum.	5	*Estimation of total cholesterol in serum.	4	CO2
LLO 6.1 Identify bilirubin in urine by fouchet's test	6	*Detection of bilirubin in urine by faucet's test.	4	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Analyze direct and indirect bilirubin in serum.	7	*Estimation of direct and indirect bilirubin in serum.	4	CO3
LLO 8.1 Analyze alkaline phosphatase in serum	8	*Determination of alkaline phosphatase in serum.	4	CO3
LLO 9.1 Measure SGPT activity	9	*Determination of SGPT activity.	4	CO3
LLO 10.1 Measure SGOT activity	10	*Determination of SGOT activity.	4	CO4
LLO 11.1 Assess triglyceride in serum	11	*Estimation of triglyceride in serum.	4	CO4
LLO 12.1 Assess Urea in blood.	12	*Estimation of blood urea.	4	CO5
LLO 13.1 Estimate Creatinine in serum	13	Estimation of Creatinine in serum	4	CO5
LLO 14.1 Estimate Creatinine in urine	14	Estimation of Creatinine in urine	4	CO5
LLO 15.1 Conduct pregnancy test	15	Pregnancy Test	4	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Prepare chart/wooden board/electric board of bilirubin formation and excretion
- Prepare chart/wooden board/electric board of urea cycle
- Prepare chart/wooden board/electric board of different biomarkers.
- Prepare chart/wooden board/electric board of lipid metabolism
- Prepare chart/wooden board/electric board of abnormal clinical conditions.
- Prepare chart/wooden board/electric board of glycolysis, gluconeogenesis and Kreb’s cycle
- Prepare chart/wooden board/electric board of working of the heart
- Prepare chart/wooden board/electric board of kidney function
- Prepare chart/wooden board/electric board of thyroid function

Assignment

- Collect information on possible risk factors for myocardial infarction
- Identify the 5 persons suffering from cholesterolemia and atherosclerosis by blood reports
- Identify 5 persons suffering from jaundice by evaluating their blood reports
- Collect blood reports of 5 persons suffering from diabetes, analyze the data and interpret results
- Collect market rates of different cardiac marker test
- Prepare and present different types of ELISA

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Glucometer	1
2	Consumable and Reagent- Test tube, Beaker Pipette, Reagent: N-(1-Naphthyl)ethylenediamine dihydrochloride reagent, Urea Standard, Picric acid Reagent, Creatinine Standard, triglyceride standard, Glucose oxidase reagent, Cholesterol oxidase reagent and Cholesterol standard, 4 aminoantipyrin reagent Cholesterol esterase, Biuret reagent.	3,5,6,9,11,12,13
3	Analytical Balance	All
4	Centrifuge	All
5	Colorimeter	All
6	Autoanalyzer	All
7	Incubator	All
8	Micropipette	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Carbohydrate and Protein Metabolism	CO1	10	2	10	4	16
2	II	Lipids and Minerals Metabolism	CO2	10	6	6	4	16
3	III	Hepatic Function Test	CO3	8	2	6	4	12
4	IV	Cardiac Profile Test	CO4	9	2	4	4	10
5	V	Kidney and endocrine and Function Test.	CO5	8	6	6	4	16
Grand Total				**45**	**18**	**32**	**20**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Class Test/Progressive Assessment

- Record book/Journals

Summative Assessment (Assessment of Learning)

- End Term Examination, Viva-voce
- Practical examination

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	3	2	2	2	1	3			
CO2	3	3	2	2	2	1	3			
CO3	3	3	2	2	2	1	3			
CO4	3	3	2	1	1	-	3			
CO5	3	3	2	1	2	1	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Deb & Deb	Fundamental of Biochemistry	New Central Agency. Kolkata, ISBN 13:9788173811449
2	Ramkrishna, Prasanna and Rajan	Text Book of Biochemistry	Orient Longman Ltd, ISBN 978825020714
3	Rama Rao	Text Book of Biochemistry	UBS Publication ISBN 10:817476660X
4	P.B Godkar and D.P Godkar	Text Book of Medical Laboratory Technology	Bhalani Publishing House, Mumbai-12 ISBN: 9789381496190
5	J.L Jain	Fundamental of Biochemistry	S.Chand &CO ISBN: 9788121924535

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=0DIMyupbLAM	Estimation of blood sugar by glucometer.
2	https://www.youtube.com/watch?v=BwQsh1TDSMM	Estimation of glycosylated hemoglobin in blood.
3	https://www.youtube.com/watch?v=IlvO-di7Ve8	Estimation of Albumin/Globulin ratio by biuret method.
4	https://www.youtube.com/watch?v=gy-StlALDIY	Estimation of total calcium in serum.
5	https://www.youtube.com/watch?v=d0dNTAdhs6Y	Estimation of total cholesterol in serum.

CLINICAL BIOCHEMISTRY **Course Code : 324315**

Sr.No	Link / Portal	Description
6	https://www.youtube.com/watch?v=cPXi7vyJN8w	Detection of bilirubin in urine by fouchet's test
7	https://www.youtube.com/watch?v=wpj1Y6Z9tHk	Estimation of direct and indirect bilirubin in serum.
8	https://www.youtube.com/watch?v=D_NCevZ76UI	Determination of alkaline phosphatase in serum
9	https://www.youtube.com/watch?v=dbDMgKyTeNM	Determination of SGPT activity
10	https://www.youtube.com/watch?v=SkhjlP0WJuo	Determination of SGOT activity
11	https://www.youtube.com/watch?v=Hlfi0TAXsrU	Estimation of triglyceride in serum
12	https://www.youtube.com/watch?v=VfzDE9R3M6E	Estimation of blood urea
13	https://www.youtube.com/watch?v=-4smUapjbNY	Estimation of Creatinine in serum
14	https://www.youtube.com/watch?v=p0ehVVlADwI	Perform pregnancy test

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

HEMATOLOGY **Course Code : 324316**

Programme Name/s : **Medical Laboratory Technology**
Programme Code : **ML**
Semester : **Fourth**
Course Title : **HEMATOLOGY**
Course Code : **324316**

I. RATIONALE

Hematological diseases are disorders which primarily affect the blood and blood forming organs. These diseases affect millions of peoples worldwide. Study of hematology and blood banking helps in diagnosis of hematological disorders and common blood bank procedure respectively.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Perform tests for diagnosing hematological disorders as per recommended procedure for blood banking.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Estimate Blood composition and hemoglobin levels .
- CO2 - Measure Erythrocyte Count, ESR, PCV for identification of anemia in given blood sample.
- CO3 - Measure WBC count and specify normal and abnormal variations.
- CO4 - Diagnose heamatological disorder using Coagulation of blood mechanism and heamoglobinopathies .
- CO5 - Identify Blood group and suggest suitable blood for trasfusion .

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324316	HEMATOLOGY	HEM	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Justify importance of healthy blood with reference to its functions and composition TLO 1.2 Select relevant Blood collection technique in specified situation TLO 1.3 Explain importance of values of hemoglobin with reference to its structure and function TLO 1.4 Explain methods of hemoglobin estimation	**Unit - I Blood and hemoglobin** 1.1 Definition of blood, composition of blood, function of blood 1.2 Blood collection techniques (capillary puncture method and vein puncture method) 1.3 Structure of hemoglobin and functions of hemoglobin and normal value of hemoglobin 1.4 Different method of hemoglobin estimation a:Sahlis method b: cyanmethamoglobin method	Model Demonstration Video Demonstrations Lecture Using Chalk-Board Group Discussion Ppt Chart
2	TLO 2.1 Explain morphology and composition of RBC TLO 2.2 Describe Functions of RBC TLO 2.3 Determine ESR and PCV TLO 2.4 Distinguish between different types of anemia	**Unit - II Erythrocyte/ RBC, ESR, PCV and Anemia** 2.1 Morphology, Composition, Normal value, Physiological variations in RBC 2.2 Erythropoiesis, functions of RBC 2.3 Definition, clinical significance, methods of determination of ESR(Wintrobe method, Western green method), definition of PCV and red cell indices 2.4 Definition of anemia, types of anemia(hemolytic, iron deficiency, hemorrhagic, aplastic)	Video Demonstrations Lecture Using Chalk-Board Ppt Model Demonstration Role Play Chart

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Justify importance of WBC count with reference to its classes and function TLO 3.2 Describe the condition of leucopoeisis and Thrombopoeisis TLO 3.3 Describe the morphology, properties and functions of platelets TLO 3.4 Describe different methods of counting of WBC	**Unit - III Leucocyte/ WBC and thrombocytes (Platelets)** 3.1 Classification, normal count and functions of WBC 3.2 Thrombopoeisis and leucopoeisis (definition, site and stages of development) 3.3 Morphology, properties, functions of platelets 3.4 Total leucocyte count, differential leucocyte count, comparison of two	Lecture Using Chalk-Board Model Demonstration Video Demonstrations Ppt Role Play
4	TLO 4.1 Describe mechanism of coagulation TLO 4.2 Explain determination of platelets count and prothrombin time TLO 4.3 Describe stepwise procedure of hemoglobin solubility test - sickling test, hemoglobin solubility test TLO 4.4 Classify conditions of Thalassemia	**Unit - IV Coagulation of blood and hemoglobinopathies** 4.1 Coagulation-definition, mechanism, factors, disorders of coagulation 4.2 Lab diagnosis of hemorrhagic disorders Hess capillary test,Resistance test, platelets count, Prothrombin time 4.3 Definition and lab diagnosis of hemoglobinopathies -sickling test, hemoglobin solubility test 4.4 Definition and classification of thalassemia	Lecture Using Chalk-Board Model Demonstration Video Demonstrations Ppt Chart simulation in classroom
5	TLO 5.1 Explain the clinical significance of different blood group system TLO 5.2 Suggest the Cross matching test required for blood transfusion. TLO 5.3 Interpret the standard operating procedure for blood banking . TLO 5.4 Describe the Doner selection criteria , and storage of blood. TLO 5.5 Explain the process of separation of blood components and its uses.	**Unit - V Blood group and blood banking procedure** 5.1 Different blood grouping system-ABO, Rh factor, Bombay, Clinical significance of blood group 5.2 Cross matching- major and minor, coombs test DCT and ICT, complications of mismatched blood transfusions 5.3 Blood Bank - Planning, documentation 5.4 Blood bank procedure- criteria for donor selection, collection and storage of blood, preparation and uses of blood components	Video Demonstrations Presentations Lecture Using Chalk-Board Role Play Ppt Site/Industry Visit

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Perform Collection of blood (capillary puncture method and vein puncture method)	1	Collection of blood (capillary puncture method and vein puncture method)	4	CO1
LLO 2.1 Perform estimation of blood hemoglobin	2	Haemoglobin estimation by sahlis method (Acid hematin method)	4	CO1
LLO 3.1 Perform erythrocyte count using newbar's chamber	3	Erythrocyte count by newbar's chamber method	4	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Perform ESR test using wintrobe method	4	ESR by using wintrobe method	4	CO2
LLO 5.1 Perform total leucocyte count by hemocytometer method	5	Total leucocyte count by hemocytometer method	4	CO3
LLO 6.1 Perform differential leucocyte count	6	Differential leucocyte count	4	CO3
LLO 7.1 Perform platelets count	7	Platelets count	4	CO3
LLO 8.1 Perform bleeding time test of given sample	8	Bleeding time	4	CO4
LLO 9.1 Perform clotting time test of given sample	9	Determination of clotting time	4	CO4
LLO 10.1 Perform Hemoglobin solubility test	10	Hemoglobin solubility test	4	CO4
LLO 11.1 Perform ABO Grouping -	11	Blood ABO Grouping	4	CO5
LLO 12.1 Perform Rh typing	12	Rh typing	4	CO5
LLO 13.1 Perform ABO grouping-serum grouping	13	ABO grouping-serum grouping	4	CO5
LLO 14.1 Perform Cross matching-major and minor	14	Cross matching-major and minor	4	CO5
LLO 15.1 Perform Sickling test for sickle cell anemia	15	Sickling test for Sickling Cell anaemia	4	CO4
LLO 16.1 Perform Packed cell volume in red cell indices values of given sample	16	Red cell indices PCV	4	CO2

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Develop Model of sickle cell anaemia
- Collect reports of 20 samples of hematological disorders from a pathology laboratory. Tabulate the results by including patient data (Age , sex, indications etc.) Prepare a report of variation
- Wooden Model of RBC/WBC/Platelets
- Model of structure of hemoglobin
- Develop a questionnaire to Conduct Survey of anemia in women by taking 20 sample reports from laboratory for different age groups of women, prepare a report on findings as per parameters given by teacher

Chart

- Chart of erythropoisis

Assignment

- 1.Differentiate between erythropoisis and leucopoiesis 2. Distinguish the types of anaemia 3.differentiate between heamopoiesis and thrombooiesis 4.Distinguish different coagulation factors. 5. Describe Types of Heamophilia. 6.have group discussion on Red cell indices
- 1.Differentiate between ABO blood group systems and other blood group systems in world. 2. Draw a flow chart on blood groups by ABO system. 3.Distinguish the procedurs of separation of blood components and their uses
- Draw colourful Chart of structure of haemoglobin with labels
- 1. Describe structure of heamoglobin and it's classification. 2. Describe morphology of RBC with it's functions. 3. Describe morphology and structure of platelets.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Refrigerator	11,12,13
2	Glass slides	11,12,13,14,15
3	Sahlis heamoglobinometer,	2
4	Heamocytometer,	3,5,7,16
5	Wintrobe ESR test tubes , stand	4
6	Microscope	5,6,7,14
7	Stop watch	8,9
8	Capillary tubes	9
9	Torniqette, dispovan syringe	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Blood and hemoglobin	CO1	8	2	4	6	12
2	II	Erythrocyte/ RBC, ESR, PCV and Anemia	CO2	9	0	8	6	14
3	III	Leucocyte/ WBC and thrombocytes (Platelets)	CO3	8	2	8	0	10
4	IV	Coagulation of blood and hemoglobinopathies	CO4	10	2	8	6	16
5	V	Blood group and blood banking procedure	CO5	10	4	8	6	18

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
Grand Total				45	10	36	24	70

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Assignment,Self learning, Class tests
- Seminar/Presentation
- 60%Weightage to the involvement n conduction of experiment /perform individually / arrange setup.
- 40% weightage to. observation/result/timely submission/viva -voce on each experiment
- Self Learning - 10 Marks for Microproject, 10 Marks for Assignment, 05 Marks for seminar.

Summative Assessment (Assessment of Learning)

- End term Examination
- Practical oriented skills
- Viva Voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	1	2	2	2	3			
CO2	3	2	1	2	2	2	3			
CO3	3	2	1	2	2	2	3			
CO4	3	2	1	2	2	2	3			
CO5	3	2	1	2	2	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Talib VH	Text book of blood banking and transfusion medicine	2nd edition, CBS Publishers and Distributors New Delhi ISBN-13:978-8123906775
2	Ramnik sood	Medical lab technology methods and interpretation volume 1 and 2	6th Edition., JPB brothers New Delhi 2009.ISBN-13:978-8184484496

Sr.No	Author	Title	Publisher with ISBN Number
3	Monica Cheeserough	District Lab Practice in Tropical countries	Cambridge University press Fourth Edition 2012 ISBN-13:978-0521676304
4	Kanai L. Mukherjee, Anuradha Chakravarti	Medical lab technology vol. 1	Tata Mc Graw Hill Pub. Co Limited New Delhi 3rd Edition
5	Hoffman Ronald MD	Hematology Basic Principles and Practice	Elsevier Health Sciences, ISBN: 9780323733885

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/KAuJ28V17ow?si=HaNukuGhJ7Oz__XA	E.S.R. test
2	https://youtu.be/gExUCrpAKyQ?si=ypMitLN2asoaC2oB	Platelets
3	https://youtu.be/W-FUyMkConE?si=E7EQiwwgdc_LWux_	Heamatopoeisis
4	https://youtu.be/cMqwV9Vb4_Y?si=Qwr2sYY_tbePGE3T	Erithropoisis
5	https://youtu.be/VSVYgivfs9c?si=jWD1Tl2iCR69fs5J	Blood composition
6	https://youtu.be/c-XXdo-2Iaw?si=b4gOVChtm_DUEqG7	Blood cells
7	https://youtu.be/vCB65L2ChPM?si=jKzpSSZpDYW4zVHA	W.B.C.
8	https://youtu.be/xCCrTLNvSRs?si=Qp_kYoq9IH1mSCfL	Coagulopathies
9	https://youtu.be/gExUCrpAKyQ?si=ypMitLN2asoaC2oB	Platelets
10	https://youtu.be/ejTULT7zIUs?si=ZAL35jRzqF7surWk	Blood banking

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MEDICAL BACTERIOLOGY **Course Code : 324317**

Programme Name/s : **Medical Laboratory Technology**
Programme Code : **ML**
Semester : **Fourth**
Course Title : **MEDICAL BACTERIOLOGY**
Course Code : **324317**

I. RATIONALE

The principles of medical bacteriology have wide applications in many branches of medicine. Identification of pathogenic bacteria helps in laboratory diagnosis of various bacterial diseases. It also helps in finding suitable antimicrobial agents for treatment.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use relevant staining solutions, test reagents, and culture media for bacterial identification.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Justify importance of normal flora in disease diagnosis
- CO2 - Distinguish gram positive and gram negative cocci on the basis of disease
- CO3 - Identify E.coli, salmonella, and other bacteria using standard laboratory diagnosis protocol
- CO4 - Apply proper staining techniques to identify mycobateria and pseudomonas
- CO5 - Plan appropriate collection and processing method for different specimen

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324317	MEDICAL BACTERIOLOGY	MBA	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the Normal flora, resident flora TLO 1.2 Categorize normal flora different body parts TLO 1.3 Justify importance of GLP for bacteriology laboratory TLO 1.4 Explain Koch's postulates TLO 1.5 Explain morphology, pathogenicity and lab diagnosis of Treponema pallidum	**Unit - I Basic Medical Bacteriology and Spirochetes** 1.1 Normal bacterial flora – Definition and Normal flora of – Mouth, Skin, and Gastro intestinal tract. 1.2 Good laboratory practices in bacteriology laboratory 1.3 Koch's postulates - Statements 1.4 Spirochetes- Treponema pallidum - Morphology, pathogenicity and laboratory diagnosis	Video Demonstrations Flipped Classroom Collaborative learning Presentations
2	TLO 2.1 Describe morphology of pathogenic cocci TLO 2.2 Differentiate cultural characters of pathogenic cocci TLO 2.3 Explain pathogenesis of pathogenic cocci TLO 2.4 Explain Laboratory diagnosis of pathogenic cocci	**Unit - II Study of Pathogenic cocci** 2.1 Morphology ,cultural characters, pathogenicity and laboratory diagnosis of Gram positive cocci - Staphylococcus aureus, Streptococcus pyogens 2.2 Morphology ,cultural characters, pathogenicity and laboratory diagnosis of Gram negative cocci - Neisseria meningitides (Meningococcus), Neisseria gonorrhoeae (Gonococcus)	Video Demonstrations Presentations Flipped Classroom Collaborative learning

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Describe morphology of pathogenic bacilli TLO 3.2 Differentiate cultural characters of pathogenic bacilli TLO 3.3 Explain pathogenesis of pathogenic bacilli TLO 3.4 Explain Laboratory diagnosis of pathogenic bacilli	**Unit - III Study of Pathogenic bacilli** 3.1 Gram negative bacilli-Morphology, cultural characters, pathogenecity and laboratory diagnosis of – Escherichia coli, Salmonella typhi, and Vibrio cholera. 3.2 Gram positive bacilli – Morphology, cultural characters, pathogenecity and laboratory diagnosis of – Corynebacterium diphtheriae 3.3 Gram positive anaerobes – Morphology, cultural characters, pathogenecity and laboratory diagnosis of – Clostridium tetani	Video Demonstrations Flipped Classroom Presentations Collaborative learning
4	TLO 4.1 Describe morphology of Mycobacterim tuberculosis, Pseudomonas aurogenosa TLO 4.2 Differentiate cultural characters of Mycobacterim tuberculosis, Pseudomonas aurogenosa TLO 4.3 Explain pathogenesis of Mycobacterim tuberculosis, Pseudomonas aurogenosa TLO 4.4 Explain Laboratory diagnosis of Mycobacterim tuberculosis, Pseudomonas aurogenosa	**Unit - IV Study of Mycobacteria and Pseudomonas** 4.1 Morphology, cultural characters, pathogenecity and laboratory diagnosis of – Mycobacterim tuberculosis 4.2 Morphology, cultural characters, pathogenecity and laboratory diagnosis of – Pseudomonas aurogenosa	Video Demonstrations Flipped Classroom Presentations
5	TLO 5.1 Recommend standard protocols for collection and storage of - Urine, Stool, Sputum, Blood TLO 5.2 Select standard protocol for processing and disposal of - Urine, Stool, Sputum, Blood	**Unit - V Diagnostic Bacteriology** 5.1 Collection, Storage, processing and disposal of Urine 5.2 Collection, Storage, processing and disposal of Stool. 5.3 Collection, Storage, processing and disposal of Sputum 5.4 Collection, Storage, processing and disposal of Blood	Video Demonstrations Flipped Classroom Presentations Site/Industry Visit Collaborative learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify normal microorganisms present on skin	1	*Perform Isolation of microflora from human skin	4	CO1
LLO 2.1 Diagnose person suffering from syphilis	2	*Perform RPR test	4	CO1
LLO 3.1 Diagnose streptococcal infection	3	*Perform ASO titer test	4	CO2
LLO 4.1 Diagnose staphylococcal infection	4	*Perform CRP test	4	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 5.1 Diagnose salmonella (typhoid) infection	5	*Perform slide Widal test	4	CO3
LLO 6.1 Predict presence of Corynebacterium diphtheriae in given sample	6	*Perform Gram's staining for detection of Corynebacterium diphtheriae	4	CO3
LLO 7.1 Predict presence of Pseudomonas auroginosa in suspected sample	7	*Perform isolation of Pseudomonas auroginosa on MacConkey's agar	4	CO4
LLO 8.1 Collect and plan suitable test by processing blood	8	*Perform collection and processing of Blood.	4	CO5
LLO 9.1 Identify normal microflora at human throat	9	Perform Isolation of microflora from human throat	4	CO1
LLO 10.1 Diagnose virulent staphylococci	10	Perform coagulase test	4	CO2
LLO 11.1 Determine causative agent of urinary tract infection	11	Perform isolation of E. coli from urine sample	4	CO3
LLO 12.1 Predict presence of Clostridium tetani in suspected sample	12	Perform Gram's staining to detect Clostridium tetani in suspected sample	4	CO3
LLO 13.1 Diagnose recent tuberculosis infection	13	Perform Mantoux test	4	CO4
LLO 14.1 Collect and plan suitable test by processing urine	14	Perform collection and processing of Urine	4	CO5
LLO 15.1 Collect and plan suitable test by processing stool	15	Perform collection and processing of Stool	4	CO5
LLO 16.1 Collect and plan suitable test by processing sputum	16	Perform collection and processing of Sputum.	4	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Prepare model of microbiology laboratory
- Prepare wooden model of RPR test kit

Assignment

- Prepare charts of Gram positive cocci
- Prepare charts of Gram negative cocci.
- Prepare charts of Gram positive bacilli
- Prepare charts of Gram negative bacilli
- Collect information on Typhoid and submit a report

- Collect information on Tuberculosis and prepare a report.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Microscope	1,6,11,12
2	Autoclave	1,7,8,9,11,14,15,16
3	Incubator	1,7,9,11
4	Electronic Balance	1,7,9,11
5	Refrigerator	2,3,4,5
6	Laminar Air Flow Machine	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basic Medical Bacteriology and Spirochetes	CO1	9	6	4	4	14
2	II	Study of Pathogenic cocci	CO2	9	4	4	6	14
3	III	Study of Pathogenic bacilli	CO3	9	2	0	12	14
4	IV	Study of Mycobacteria and Pseudomonas	CO4	9	2	4	8	14
5	V	Diagnostic Bacteriology	CO5	9	0	8	6	14
Grand Total				**45**	**14**	**20**	**36**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Journals/ Record Book 25 Marks
- 2 Progressive assessment theory/ Class test each 30 marks

Summative Assessment (Assessment of Learning)

- End Semester Examination 25 Marks

- Self learning - Assignments 10 Marks
- Self learning - Microproject 10 Marks
- Self learning - Presentation 05 Marks

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	1	-	1	-	2			
CO2	3	3	2	1	-	1	3			
CO3	1	3	3	2	1	1	3			
CO4	2	3	3	1	1	-	2			
CO5	1	2	2	2	3	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	R Ananthanarayan (Author), CK Jayaram Paniker (Author), Reba Kanungo (Editor), Sonal Saxena (Editor)	Ananthanarayan and Paniker's Textbook of Microbiology, Twelfth Edition	Universities Press Publications, ISBN-13: 978-9393330017
2	Sastry Apurba S , Bhat Sandhya	Essentials of Medical Microbiology	Jaypee Brothers Medical Publishers ISBN-13: 978-8194709015
3	V Baveja, C P Baveja	Text And Practical Microbiology For MLT 3ed	Arya Publishing Company, ISBN-13: 978-9394102675
4	Robert Cruickshank et all	Medical Microbiology Vol .I and II	London Churchill Livinginhstone, 9780443011115
5	P. Chakraborthy	A textbook of Microbiology	Calcutta New Central book agency, 978-8173818769
6	D R Arora	Textbook of Microbiology 6 Ed	CBS; 6th edition, ISBN-13 ? : ? 978-9389565935

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description

MEDICAL BACTERIOLOGY **Course Code : 324317**

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=JYRkXhT1XEs	Microorganisms and Humans: Commensal and Pathogenic Flora
2	https://www.youtube.com/watch?v=xwQ_YRJHWKA	Normal Flora
3	https://www.youtube.com/watch?v=PelzMSM7tcI	Syphilis pathogenesis || Treponema pallidum in hindi
4	https://www.youtube.com/watch?v=bMdgzyWPWP8	Staphylococcus Aureus Bacteria | Microbiology Bacteria | Gram Positive Cocci | Lab Diagnosis
5	https://www.youtube.com/watch?v=RaFxnvCvLSM	Streptococcus Pyogenes Bacteria | Streptococcus bacteria microbiology | Streptococcus bacteria notes
6	https://www.youtube.com/watch?v=6QSudOk_AqQ	Neisseria Meningitidis Microbiology | Neisseria Meningitidis in hinid | What is Meningitidis
7	https://www.youtube.com/watch?v=mvM_I8U9tIY	Neisseria Gonorrhoeae Microbiology | Neisseria Gonorrhoeae in hindi | Bacteria notes microbiology
8	https://www.youtube.com/watch?v=gxw1f8A2qJQ	Escherichia coli, pathogenesis, clinical manifestations and lab diagnosis in hindi
9	https://www.youtube.com/watch?v=igJE35I3Eks	Salmonella Bacteria | Typhoid | Enteric Fever| Typhoid Fever| Paratyphoid Fever| Widal Test in hindi
10	https://www.youtube.com/watch?v=j0bJ5xftmNU	Cholera disease in Hindi | Causes, Symptoms, Pathophysiology, Diagnosis & Treatment | Notes
11	https://www.youtube.com/watch?v=MlD4VIMjJMQ	CORNEYBACTERIUM DIPHTHERIA MICROBIOLOGY / corneybacterium microbiology lecture
12	https://www.youtube.com/watch?v=2aHqbX6rsXM	Clostridium tetani,pathogenesis, lab diagnosis, treatment & prophylaxis (in hindi)
13	https://www.youtube.com/watch?v=4Ld8HfoRX0I	Mycobacterium Tuberculosis in hindi | Tuberculosis in hindi | Pulmonary Tuberculosis | Treatment TB
14	https://www.youtube.com/watch?v=d58fBKD9Zbk	Pseudomonas aeruginosa pathogenesis, lab diagnosis & treatment || microbiology (in hindi)

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s : **Medical Laboratory Technology**
Programme Code : **ML**
Semester : **Fourth**
Course Title : **HISTOTECHNIQUE**
Course Code : **324012**

I. RATIONALE

The course on histotechnique offers a comprehensive understanding of tissue preparation for microscopic examination, vital for medical laboratory technicians. This course provide hands-on skills related to techniques for tissue fixation, embedding, section cutting, staining, and analysis. Histotechnique helps in understanding the deteriorated condition of an organ and the severity of infection/disease in the body.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Provide histological slides of different tissues for detection of the intensity of the infection/ diseases in the organ

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Gross the tissue obtained by biopsy or autopsy
- CO2 - Select the appropriate fixatives for fixation of tissue
- CO3 - Check completion of decalcification process of given tissue
- CO4 - Prepare paraffin block of given tissue using appropriate technique
- CO5 - Prepare the histological slides of given sample

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324012	HISTOTECHNIQUE	HIS	SEC	1	-	4	1	6	3	-	-	-	-	-	50	20	25@	10	25	10	100

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Draw a well labeled diagram of cell and tissue TLO 1.2 Describe the method of specimen collection for histological techniques TLO 1.3 Explain the procedure for collection and grossing of sample	**Unit - I Histopathology** 1.1 Introduction and Importance of histopathology and cytopathology 1.2 Arrangement and working of histopathology laboratory, perform various histotechnique 1.3 Definition, structure and function of cell and tissue 1.4 Different methods of specimen collection for Histotechniques and grossing of it 1.5 Safety precaution in Histotechniques	Video Demonstrations Flipped Classroom Presentations Lecture Using Chalk-Board
2	TLO 2.1 Define fixation of tissue TLO 2.2 Explain the criteria of ideal fixative TLO 2.3 Select the appropriate fixative for given sample of tissue	**Unit - II Fixation** 2.1 Definition, Aim, Criteria of ideal fixatives 2.2 Classification of fixatives 2.3 Simple fixatives 2.4 Compound fixatives 2.5 Special Fixatives	Lecture Using Chalk-Board Video Demonstrations Power point Presentations Role Play
3	TLO 3.1 Explain the advantages and disadvantages of Decalcifying agents TLO 3.2 Explain the process of Decalcification TLO 3.3 Describe the tests for Decalcification	**Unit - III Decalcification** 3.1 Definition, properties and types of decalcifying fluids 3.2 Study of advantages and disadvantages of the decalcifying agent 3.3 Detection of end point of decalcification by completion test 3.4 Various chemicals and reagent requires for checking of decalcification 3.5 Precaution in decalcification	Presentations Video Demonstrations Lecture Using Chalk-Board Collaborative learning

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Describe the process of dehydration in tissue processing TLO 4.2 Process the dehydrated tissue by clearing TLO 4.3 Describe the steps for preparation of impregnation and Infiltration media TLO 4.4 Describe the steps for block of processed tissue i.e. embedding TLO 4.5 Describe construction and use of automatic tissue processer	**Unit - IV Tissue Processing** 4.1 Dehydration - Aim, agents and its Properties 4.2 Clearing - Aim, agents and its Properties 4.3 Impregnation and infiltration media 4.4 Embedding - Block preparation and storage 4.5 Automatic tissue processor - construction and use	Presentations Video Demonstrations Lecture Using Chalk-Board
5	TLO 5.1 Describe construction and use of Rotary microtome TLO 5.2 Explain the honing and stropping technique TLO 5.3 Explain the process of section cutting by microtome TLO 5.4 Explain the steps for performing H and E staining of tissue mounted slide TLO 5.5 Explain the steps for performing Papanicolaou staining of Smear	**Unit - V Microtomy and Staining** 5.1 Study of various microtomes and microscopes 5.2 Use and care of Rotary microtome 5.3 Sharpening and microtome knief by Honing and Stropping 5.4 Actual section cutting- Floating out techniques 5.5 Staining - Haematoxylene and Eosin stains 5.6 Cytopathology - Gynaecological and non gynaecological sample - collection, preservation, staining	Video Demonstrations Demonstration Lecture Using Chalk-Board Role Play Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Arrange properly instruments and chemicals / reagents used in histopathology laboratory	1	Arrangement and instruments and chemical/ reagent in histopathology laboratory	4	CO1
LLO 2.1 Fix the tissue by appropriate fixative	2	Fixation of obtained sample by Biopsy/ Autospy	4	CO2
LLO 3.1 Decalcify the tissue and check it for completion	3	Decalcification process and end point	4	CO3
LLO 4.1 Dehydrate the tissue with proper dehydrating agent	4	Dehydration - different aspects and procedure	4	CO4
LLO 5.1 Clear the tissue by appropriate clearing agent	5	Clearing various agents and process	4	CO4
LLO 6.1 Prepare the media for impregnation and infiltration	6	Impregnation - Proper media and duration	4	CO4
LLO 7.1 Prepare the Paraffin block by using L mould	7	Embedding : Paraffin block preparation	4	CO4
LLO 8.1 Tream and store the tissue embedded block	8	Treaming and storage of tissue embedded block	4	CO4
LLO 9.1 Sharpe the microtome knife	9	Sharpening and microtome knief by honing and stropping	4	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Cut the processed tissue by using microtome	10	Microtomy actual section cutting	4	CO5
LLO 11.1 Mount the tissue section on slide	11	Mounting of section (floating out techniques)	4	CO5
LLO 12.1 Up keep and preventive care of rotary microtome	12	Use, care and precaution of rotary microtome	4	CO5
LLO 13.1 Stain the histoslides by Haematoxylene and Eosin staining	13	Haematoxylene and Eosin staining	4	CO5
LLO 14.1 Mount the tissue sections by using DPX	14	Permanent mounting by using DPX and deserrtative of slide	4	CO5
LLO 15.1 Prepare smear of Cytopathological specimen	15	Smear preparation of gynacological and nongynacological samples	4	CO5
LLO 16.1 Stain the smear with Papanicolaou staining	16	Popanicolaou staining	4	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Prepare flow diagram of Histotechniques
- Prepare charts of microscope and microtome
- Survey for cancer patients
- Design an effective campaigning poster for awareness regarding cancer of various organs in English Hindi and marathi languages

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Compound Microscope	1,5
2	Tissue cutting knife	2
3	Tissue capsule	2,3,4
4	Staining Racks and stains	3,5
5	Paraffin wax bath with copper cups	4
6	Leukhart's L Embedding blocks	4
7	Yellow belgium water stone and Strop	5
8	Rotary Microtome	5

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Histopathology	CO1	3	0	0	0	0
2	II	Fixation	CO2	3	0	0	0	0
3	III	Decalcification	CO3	3	0	0	0	0
4	IV	Tissue Processing	CO4	3	0	0	0	0
5	V	Microtomy and Staining	CO5	3	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Practical journals (as per the guide line issue by MSBTE)

Summative Assessment (Assessment of Learning)

- Practical examination, Viva-voce

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	1	-	1	-	2			
CO2	3	1	3	-	3	-	3			
CO3	2	2	3	-	1	-	3			
CO4	3	3	2	-	1	-	3			
CO5	3	3	2	-	3	-	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Baker F.J. R. E. Silverton	Introduction to Medical laboratory Technology	EIBS London 5th edition 1980-82
2	Medical college Nagpur	Manual of Histopathology	Students store GMC Nagpur
3	By L. G. Koss	Diagnostic Cytology Vol. I & II	J. B. Lippincott Co. Philadelphia 3rd Edition 1979
4	By Monica Cheesbrough	Medical lab Manual for tropical countries	EIBS London 1987
5	By Kanai Mukherjee	Medical Lab Technology Vol. I, II, III	Tata N. C. Graw Hill 1988
6	Sadhana Vishwakarma	Techniques in histopathalogy and cytopathalogy	Jaypee Brothers Medical Publishers Pvt. Limited, 2017 9352701097, 9789352701094

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/Hf1-CLm0u08?si=rRjKwmhXR7CP4atY	Introduction of cytopathology
2	https://youtu.be/4DJm4NLECQs?si=dSCQEI-w8SQSyEP5	Histology technique and equipment
3	https://youtu.be/xSgHVy62ckc?si=XvIpfoW-cZaxelYG	Tissue processing
4	https://youtu.be/7-LIbAWPc-g?si=J9QKV0ZSSHKgbsg_	Tissue processing , Embedding, section for histology
5	https://youtu.be/vln689JrssQ?si=jfthXoCRJktD5Jc7	Fixative and types of fixatives
6	https://youtu.be/OAATyrRNPQU?si=lFNphvINn7Gn0xNE	Decalcification
7	https://youtu.be/MslMX5JNXGM?si=gkv9452pkcbRFMe6	Types of Decalcification
8	https://youtu.be/1jgY-u6u-j4?si=V3q8Cmh932ISXWRT	Microtome
9	https://youtu.be/2D0rj0m6dVs?si=XCiFlXlBb-vHT5RH	H and E staining
10	https://youtu.be/KnMdSgd5mts?si=0psKWcAYBtidI0xx	Rotary microtome section
11	https://youtu.be/MWHxq_Xly-A?si=xxb2sFTsrLgabMcj	Microtomy, Block cutting

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

LABORATORY MANAGEMENT AND ETHICS **Course Code : 324013**

Programme Name/s : **Medical Laboratory Technology**
Programme Code : **ML**
Semester : **Fourth**
Course Title : **LABORATORY MANAGEMENT AND ETHICS**
Course Code : **324013**

I. RATIONALE

Medical laboratory needed several management & ethical issues exist within the diagnostic . The major ethical challenges such as; consent, confidentiality, codes of conduct, conflict of interest, lab utilization, proficiency, and direct access testing are some times more prevalent in resource-limited settings. The NABL/NABH applicable standards may be ensured. This course is key for managing MLT efficiently.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Acquire essential managerial and ethical skills needed to successfully run a medical diagnostic laboratory.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify general organization of specified laboratory
- CO2 - Identify different persons/professionals working in MLT
- CO3 - Implement the safety measures while using general medical laboratory equipment.
- CO4 - Adopt relevant quality control measures in medical laboratory.
- CO5 - Identify role of technology in delivering laboratory services in given situation.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
324013	LABORATORY MANAGEMENT AND ETHICS	LME	SEC	1	-	4	1	6	3	-	-	-	-	-	50	20	25@	10	25	10	100

Total IKS Hrs for Sem. : 2 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Identify the organizational level of specified medical technology laboratory. TLO 1.2 Identify duties and responsibilities of persons in specified laboratory TLO 1.3 Corelate laboratory services and activities with and code of ethics ans sustainable practices.	**Unit - I Overview of a Laboratory Organization** 1.1 levels of Laboratory (National/ State/ District). 1.2 Duties and responsibilities of laboratory personnel . 1.3 Laboratory services of health care, delivery system and code of ethics for laboratory technician, environmental sustainability considerations	Demonstration Video Demonstrations Flipped Classroom Case Study Role Play
2	TLO 2.1 Use general principles of care and cleaning of glassware TLO 2.2 Identify the storage and upkeep requirements of given laboratory chemicals and biomedical waste TLO 2.3 Use recommended procedure specimen collection and Transportation.	**Unit - II Care of laboratory glassware, chemicals, equipments and instruments.** 2.1 General principles, care and cleaning of glassware. 2.2 Laboratory chemicals - proper use, care storage and labeling, biomedical waste management. 2.3 Specimen handling - container, method of collection and transportation.	Demonstration Video Demonstrations Flipped Classroom Case Study Role Play

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Identify provisions related to general principles of safety programs. TLO 3.2 Use first aid and safety measures. TLO 3.3 Use quality control techniques in given situation of laboratory medicine by using Biostatistics	**Unit - III Laboratory safety and quality control in laboratory medicine** 3.1 General principles of safety programs. 3.2 First aid and safety measures for chemical and biological hazardous. 3.3 Quality control in laboratory medicine and Biostatistics -Mean, median, mode and standard deviation.	Video Demonstrations Flipped Classroom Case Study Presentations Role Play
4	TLO 4.1 Justify the need of quality control and quality assurance in laboratory TLO 4.2 Identify the criteria for Accreditation and quality Certification of medical laboratories. TLO 4.3 Adopt laboratory practices as per applicability of national and international guidelines.	**Unit - IV Quality control in laboratory medicine.** 4.1 Quality control and quality assurance in following sections of laboratory. a. Biochemistry b. Microbiology c. Haematology d. Histopathology 4.2 Accreditation and Quality Certification of medical laboratories. 4.3 Concept of reference range and national and international guidelines.	Video Demonstrations Flipped Classroom Case Study Presentations
5	TLO 5.1 Use basic ICT equipment in Laboratory TLO 5.2 Use computer software for day to day operations in laboratory documentation and management of records TLO 5.3 Identify social media tools and ICT devices useful for laboratory operation and management	**Unit - V Application of ICT in laboratory practice.** 5.1 Input and output devices used in medical labs, storage devices, network devices, Familiarization to software for laboratory practices, 5.2 Introduction to internet operation and safety, Laboratory Information Management System (LIMS) , use of Unicode for regional language, use of Anuvadini software 5.3 Introduction to use of IOT and AI in medical laboratory, use of social media tools, geotagging of laboratory and facilities, examples of management of lab using emerging technology	Video Demonstrations Flipped Classroom Case Study Presentations Role Play Internet based activities and assigments

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Prepare standard first aid box.	1	*Preparation of first aid box with standard contents.	2	CO3
LLO 2.1 Prepare reports of different clinical laboratory tests	2	*Prepare different laboratory report formats.	2	CO1
LLO 3.1 Use different laboratory glassware effectively.	3	*Perform follwoing tasks using laboratory glassware.	2	CO1 CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Identify different chemicals and reagents labeling and storage of various chemicals (Flammable chemicals , inflammable ,Toxic chemicals ,Organic and inorganic chemicals etc.)	4	*Identification of different chemicals and reagents to label and store chemicals.	2	CO1 CO3
LLO 5.1 Wash / clean of used glassware by using cleaning solution.	5	*Washing of used glassware by using cleaning solution(Phenol, detergent solution and chromic acid of solution).	2	CO2 CO3
LLO 6.1 Use syringe and proper containers as per standard procedure	6	*Perform collection and transportation of blood accurately.	2	CO2 CO3 CO4
LLO 7.1 Use Centrifuge to separate plasma and serum	7	*Separation of plasma and serum by centrifugation.	2	CO2 CO4
LLO 8.1 Identify quality control chart	8	*Identification of quality control chart from given data.	2	CO4
LLO 9.1 Identify biomedical waste accurately	9	*Categorization of biomedical wastes as per standard norms.	2	CO2 CO4
LLO 10.1 Prepare and maintain laboratory register	10	*Preparation and maintenance of registers for records.	2	CO2 CO3 CO4
LLO 11.1 Calculate of mean,median,mode,Standard deviation .	11	Calculation of mean, median, mode, Standard deviation.	2	CO1 CO3
LLO 12.1 Perform document creation, editing, printing using MS Word.	12	Document creation ,editing,printing,using MS Word.	2	CO5
LLO 13.1 Perform editing, and creation of slide presentation about specified Laboratory test topic using Ms Power Point	13	Creation and Editing of Power point presentation about Laboratory test using MS power point.	2	CO5
LLO 14.1 Identify Application of westgard rules.	14	Identification of westegard rules.	2	CO2
LLO 15.1 Prepare Power point presentation, editing, and creation using MS power point.	15	Preparation of PowerPoint presentation on maintenance of our laboratory Instruments. (Microscope, Centrifuge etc)	2	CO2 CO3
LLO 16.1 Prepare Charts on Good Laboratory Practices (GLP) for safety tests on chemicals	16	Preparation of Charts on Good Laboratory Practices (GLP) for safety tests on chemicals.	2	CO2 CO3 CO4

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Prepare a Chart of importance of laboratories Ethics

- Prepare and display safety charts and symbols used in Medical Laboratory practice
- Prepare a list of blood banks in your locality and prepare a questionnaire to take information about the facilities in any one laboratory. Save location of some labs in your cell phone using google maps
- Draw charts of different level laboratory(National, State, District)
- Identify method of preservation and disposal of laboratory waste.
- Prepare a Chart of Consumables and reagents used in laboratory for different common purposes. Mention following - usable period from manufacture to expiry, availability of types of its packaging- bottle, pouch ampule , purpose of the reagent, cost per volume of 100ml etc.
- Draw an ideal clinical laboratory- laboratory design
- Study the website of DIRECTORATE GENERAL OF HEALTH SERVICES (https://dghs.gov.in/content/289_3_CentralDrugsLab.aspx) and describe the functions of central drug testing laboratories in india.
- Draw various types of containers used in laboratory (Blood , Sputum, Urine, Stool)

Group Discussion on given theme

- Students in groups of 5 to 6 are made to discuss Ethical issues in Laboratory practices after studying code of ethics

Micro project

- Prepapre a chart of IOT based devices and AI based techniques used in medical laboratories and their purpose. You can visit laboratories and also search internet. Chart should be with relevant visuals
- Prepare first aid box
- Prepare quality control chart.
- Prepare a list of different laboratories in your area.
- Visit a blood bank and prepare a report including the services provided, equipment used, manpower, the type of tests carried out in lab for last 10 days. Draw a bar chart of types of tests conducted. Include in report the storage arrangements of chemical, glassware, apparatus , care of equipment.(Teachers may like to be more specific of report format)

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	First aid kit	1,2
2	Different glasswares	1,3
3	Consumables, chemicals and reagents	4
4	Desktop computer	5

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Overview of a Laboratory Organization	CO1	3	0	0	0	0
2	II	Care of laboratory glassware, chemicals, equipments and instruments.	CO2	3	0	0	0	0
3	III	Laboratory safety and quality control in laboratory medicine	CO3,CO4	3	0	0	0	0
4	IV	Quality control in laboratory medicine.	CO4	3	0	0	0	0
5	V	Application of ICT in laboratory practice.	CO5	3	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

Summative Assessment (Assessment of Learning)

- Practical exam of 25 marks

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	3	-	1	-	2			
CO2	2	2	2	-	1	-	3			
CO3	3	1	1	-	1	-	3			
CO4	3	2	1	-	1	-	3			
CO5	3	2	1	-	1	-	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Eleanor M.Travers	Clinical laboratory management	Williams and Wilkens 9781555817275
2	G.Guru	Laboratory setup and procedure	NCERT ,New Delhi 9780323595407

Sr.No	Author	Title	Publisher with ISBN Number
3	Kanai Mukherjee	Medical Laboratory Technology Vol 1	McGrew Hill 9789974632604
4	Munjal Shah	PJ Mehtas practical pathology	The National Book Depot 9789357773515

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.onepointesolutions.com/blog/the-importance-of-quality-control-in-the-laboratory/#:~:text=What%20is%20Quality%20Control%20in,something%20slips%20through%20the%20cracks	Laboratory Safety and Qualitycontrol in laboratory medicine
2	https://youtu.be/3UIU87FV3Vs?si=F3rg6syxRoOcrHXD	Laboratory safety programes
3	https://www.who.int/news-room/feature-stories/detail/laboratory-services-at-the-district-level	Laboratory at different level (National /State/District)
4	https://youtu.be/_DV8FnP7cRo?si=QmfViq2Jx28hpqqK	Care of laboratory glassware chemicals equipment and instrument
5	https://www.mlo-online.com/home/article/13007888/quality-control-in-clinical-laboratory-samples	Quality control in laboratory medicine
6	https://dghs.gov.in/content/289_3_CentralDrugsLab.aspx	Director General of Health services- Drug Testing Laboratories

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students