INTEGRAL UNIVERSITY, LUCKNOW

INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH

DEPARTMENT OF PARAMEDICAL SCIENCES

MASTER OF SCIENCE IN MEDICAL LABORATORY TECHNOLOGY
(M.Sc. MLT)

SYLLABUS

YEAR/ SEMESTER: I/I

Integral University, Lucknow Department of
Paramedical Sciences
Study and Evaluation Scheme

Program: M.Sc. MLT Semester-I

S. N.	Course code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credits
				L	T	P	CT	TA	Total	ESE			
THEORIES													
1	LT401	General Biochemistry	Core	2	1	0	40	20	60	40	100	2:1:0	3
2	LT402	General Microbiology	Core	2	1	0	40	20	60	40	100	2:1:0	3
3	LT403	Medical Laboratory Management	Core	2	1	0	40	20	60	40	100	2:1:0	3
4	LT404	General Pathology and General Hematology and Blood Banking	Core	2	1	0	40	20	60	40	100	2:1:0	3
5	LT405	Research Methodology & Biostatistics 1	Core	2	1	0	40	20	60	40	100	2:1:0	3
PRACTICAL													
1	LT406	General Biochemistry-Lab	Core	0	0	6	40	20	60	40	100	0:0:6	3
2	LT407	General Microbiology -Lab	Core	0	0	6	40	20	60	40	100	0:0:6	3
3	LT408	General Pathology and General Hematology and Blood Banking-Lab	Core	0	0	6	40	20	60	40	100	0:0:6	3
Total				**10**	**05**	**18**	**320**	**160**	**480**	**400**	**800**	**24**	**24**

S. N.	Course code	Course Title	Type of Paper	Attributes							United Nation Sustainable Development Goal (SDGs)
				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
THEORIES											
1	LT401	General Biochemistry	Core	√	√	√	√		√	√	3,4
2	LT402	General Microbiology	Core	√	√	√	√		√	√	3,4
3	LT403	Medical Laboratory Management	Core	√	√	√	√		√	√	3,4
4	LT404	General Pathology and General Hematology and Blood Banking	Core	√	√	√	√		√	√	3,4
5	LT405	Research Methodology & Biostatistics 1	Core	√	√	√	√		√	√	3,4
PRACTICAL											
1	LT406	General Biochemistry-Lab	Core	√	√	√	√		√	√	3,4
2	LT407	General Microbiology-Lab	Core	√	√	√	√		√	√	3,4
3	LT408	General Pathology and General Hematology and Blood Banking-Lab	Core	√	√	√	√		√	√	3,4

L: Lecture **T:** Tutorials **P:** Practical **CT:** Class Test **TA:** Teacher Assessment **ESE:** End Semester Examination,
AE= Ability enhancement, DSE- Discipline Specific Elective, **Sessional Total:** Class Test + Teacher Assessment **Subject Total:** Sessional Total + End Semester Examination (ESE)

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**LT401**	**Title of the Course**	**General Biochemistry**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**I**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The student will be able to demonstrate knowledge in clinical as needed for the study and practice of medical laboratory technology.						

Course Outcomes	
CO1	Students are able to learn about different unit of measurement and also about carbohydrates.
CO2	Students are able to learn about kidney function test & chemistry of carbohydrates.
CO3	Students are able to learn about different enzymes with liver function test.
CO4	Students are able to learn about different types of carbohydrates.
CO5	Students are able to learn about different cardiac profile test.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Units of Measurement** **Chemistry of Carbohydrates**	S.I unit and CGS units, Conversion, Strength, molecular weight, equivalent weight, Normality, Molarity, Molality, Numerical. Important function, Properties of carbohydrates, GTT, Glycosylated haemoglobin, Diabetic profile test	6	CO1
2	**Kidney Function Test** **Chemistry of proteins**	General Introduction, Urea estimation, Serum creatinine, Uric acid, Urea creatinine. Structure of proteins, Disorders affecting protein metabolism, Serum albumin estimation	6	CO2
3	**Enzymes** **Liver Function Test**	Enzymes as catalyst, Enzyme classification and nomenclature, SGPT, Serum amylase, SGOT, Serum lipase Liver functions, Bile pigment metabolism, Jaundice, Serum bilirubin, Alkaline phosphate determination	6	CO3
4	**Chemistry of lipids**	Definition, Lipids classification, Cholesterol, lipoprotein metabolism, Dyslipidemia, Serum total cholesterol, Serum triglycerides, total lipids determination	6	CO4
5	**Cardiac profile test**	The heart, Ischemic heart disease, Atherosclerosis, Serum CK, LDH, apolipoprotein A-1, Lipoprotein	6	CO5

Reference Books:

1. Fundamentals of Biochemistry-by Dr. Deb Jyoti Das
2. Biochemistry-by-Dr Satyanarayan.
3. Textbook of Biochemistry –Chatterje and Shinde.

e-Learning Source:

1. https://www.youtube.com/watch?v=9flJfhR_H_A
2. https://www.youtube.com/watch?v=0LceUS6pWtE
3. https://www.youtube.com/watch?v=yxhRT6zfFT8
4. https://www.youtube.com/watch?v=Jl0v2ok-2p8

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	-	1
CO2	1	3	1	3	-	-	-	1	3	-	-	3	3	2	-	2	-	1
CO3	1	3	1	2	-	-	-	1	2	-	-	2	3	1	-	1	-	1
CO4	1	3	1	2	-	-	-	1	3	-	-	3	2	1	-	1	-	1
CO5	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	-	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
LT401	General Biochemistry	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	3,4

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**LT402**	**Title of the Course**	**General Microbiology**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**I**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	This subject gives a general insight into the history, basics of microbiology and impart knowledge about equipment used in microbiology.						

Course Outcomes: After the successful course completion, learners will develop following attributes:	
CO1	This course makes the students to know handling of instruments and sterilization techniques.
CO2	This course makes the students to know general insight into the history, basics of microbiology.
CO3	This course makes the students to know imparts knowledge about equipment used in microbiology.
CO4	This course makes the students to know Structure, function and chemical composition of bacterial cell membranes.
CO5	This course makes the students to know Biomedical waste management in a Medical Microbiology laboratory: Types of the waste generated, Segregation, Treatment, Disposal.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Microscopy** **Sterilization, Antiseptics and disinfectants** **Biomedical waste management in a Medical Microbiology laboratory**	Introduction and history, Types, principle and operation mechanism of following microscopes: Light microscope, DGI, Fluorescent, Phase contrast, Electron microscope: Transmission/ Scanning Definition, Types and principles of sterilization methods, Heat (dry heat, moist heat with special Reference to autoclave), Radiation, Filtration, Efficiency testing to various sterilizers Definition, Types and properties, Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants. Types of the waste generated – Segregation – Treatment – Disposal.	6	CO1
2	**Culture media and Stains**	Introduction, Classification of culture media, Quality control in culture media, Automation in culture media preparation, Concepts, Methods Used for aerobic cultures, Methods used for anaerobic cultures, staining principle, Different stains used in bacteriology.	6	CO2
3	**Biochemical tests for Bacterial identification**	Identification of different bacteria: - Catalase, Coagulase, Indole, Methyl Red, Voges Proskauer, Urease Citrate, Oxidase, TSIA, Nitrate reduction, Carbohydrate fermentation, Huge and Leif son, Bile solubility H 2 S production, Demonstration of motility, Decarboxylases, CAMP, Hippurate hydrolysis, Nagler's reaction, Cholera-red reaction	6	CO3
4	**Antibiotic susceptibility testing in bacteriology**	: Definition of antibiotics, Culture medium used for Antibiotic susceptibility testing, Preparation and standardization of inoculum, control bacterial strains, Choice of antibiotics, MIC and MBC: Concepts and methods for determination, Various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method	6	CO4
5	**Molecular methods in bacterial culture detection** **Epidemiological markers** **Preservation methods for microbes**	Principles and importance. Basics of Nucleic acid techniques in diagnostic microbiology with special reference to Polymerase chain reaction (PCR) Introduction, Types, Serotyping, Phage typing and Bacteriocin typing Basic concepts of preservation of microbes, why do we need to preserve bacteria, Principle and procedures of various short term and long-term preservation methods with special reference to Lyophilization	6	CO5

Reference Books:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
2. Brooks G.F., CarrollK.C., ButelJ.S., MorseS.A.andMietzner,T.A.(2013).
3. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.
5. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, NewYork.

e-Learning Source:

1. https://www.babcock.edu.ng/oer/lecture_notes/mlsc/MLSC%20417%20HISTORY%20OF%20MICROBIOLOGY.ppt
2. https://www.tru.ca/__shared/assets/Microbiology_Lab_Safety39696.pdf
3. https://www.healthline.com/health/what-is-antiseptic

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	-	-	-	1	2	1	-	2	2	1	-	1	-
CO2	1	3	1	3	-	-	-	2	3	-	-	3	3	2	-	2	-
CO3	1	3	1	2	-	-	-	1	2	2	-	2	3	1	-	1	-
CO4	1	3	1	2	-	-	-	1	3	-	-	3	2	1	-	1	-
CO5	1	3	1	2	-	-	-	1	2	1	-	2	2	1	-	1	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT402	General Microbiology	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√	-	√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**LT403**	**Title of the Course**	**Medical Laboratory Management**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**I**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	**The students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab.**						

Course Outcomes	
CO1	Student will be able to gain knowledge about Ethical Principles, Good Laboratory Practice (GLP)
CO2	Student will be able to gain knowledge about ethics & laws used in laboratory
CO3	Student will be able to gain knowledge about Quality Management system, Quality assurance, Quality control system, Inventory Control
CO4	Student will be able to gain knowledge about Awareness / Safety in a clinical laboratory and General safety precautions
CO5	Student will be able to gain knowledge about principles and management of different Auto analyzer.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	GLP	Pathological clinics Ethics of the pathological clinics Pathology laboratory, Organization to a pathology laboratory under board of quality control Development Personality development and patient relationship Reports writing Pathology reports writing	6	CO1
2	Ethics & Laws	Accountancy in clinical pathology Operation ethics Introduction Operation ethics Social ethics Introduction techniques social ethics of pathology Instruments Proper handling to instruments Administration of Laborites	6	CO2
3	Quality control & Personality development	Operation Hazardous compound Chemical solvent poisons isotopes, explosives and biological strains Pathological clinics Ethics of the pathological clinics Organization of a pathology laboratory under board of quality control Personality development and patient relationship Pathology reports writing	6	CO3
4	Awareness / Safety in a clinical laboratory	Accountancy in clinical pathology Hospital Management Operation ethics social ethics of pathology. Proper handling of instruments Laboratory management and use of computer in laboratory. Laboratory safety, Personal management, Record keeping, Data analysis. Applications of computer in laboratory. Workload analysis Finance: Budgeting, operational expenses, cost accounting, justification of budget.	6	CO4
5	Fully/Semi Auto analyzer.	Principles, Application and maintenance of Auto analyzers, Blood gas analyzers, Electrolyte analyzer, Chemiluminescence.	6	CO5

Reference Books:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6 th edition,ElsevierPublications
2. Bishop (2013), Clinical Chemistry,7 th edition,WileyPublications
3. Henry's Clinical diagnosis and management by Laboratory Methods (2011), 22 nd edition, Elsevier.

e-Learning Source:

1. https://nata.com.au/accreditation/oecd-principles-of-good-laboratory-practice/
2. https://www.icao.int/NACC/Documents/Meetings/2016/AIMQMS/QMSFPLAIMP04.pdf
3. http://virology-online.com/general/QualityControl4.htm

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	-	-	-	1	2	-	-	2	3	1	2	3	-
CO2	1	3	1	3	-	-	-	2	3	-	-	3	3	-	1	2	-
CO3	1	3	1	2	-	-	-	1	2	-	-	2	2	2	1	2	2
CO4	1	3	1	2	-	-	-	1	3	1	-	3	2	3	1	3	2
CO5	1	3	1	2	-	-	-	1	2	2	-	2	3	1	2	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT403	Medical Laboratory Management	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√	-	√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**LT404**	**Title of the Course**	**General Pathology and General Hematology and Blood Banking**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**I**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The students will be made aware of the General Pathology. In addition, they will understand Mechanism of disease, its Nature, processes, pathogenesis and accountability.						

Course Outcomes	
CO1	Students are able to learn about Blood & its investigations.
CO2	Students are able to learn about morphology of RBC & coagulation profile.
CO3	Students are able to learn about cell injuries & cell death.
CO4	Students are able to learn about Haemodynamic disorder.
CO5	Students are able to learn about Immunohematology & blood banking.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Blood** **Hemoglobin** **Hemocytometry** **Blood film** **Erythrocyte sedimentation rate** **Packed cell volume**	Physiology of blood cells, Hematopoiesis Introduction, its composition and functions, types of hemoglobin, methods to measure with merits and demerits, Absolute Values Introduction, Principle, Reagent preparation, RBC count, WBC count, Platelet count Errors and Remedies Preparation, staining, Differential leucocyte count, Blood cell morphology, Normal and abnormal morphologies in malarial parasites, PBF in Filariasis Introduction, Principle, Mechanism and different methods with merit and demerits for measuring ESR and its significances, Absolute values Introduction, Principle, Mechanism and different methods with merits and demerits for measuring PCV and its significance, Absolute values	6	CO1
2	**Red cell anomalies** **Reticulocytes** **Hemostasis**	Morphological changes such as variation in size shape & staining character Definition, different methods to count, Absolute reticulocyte count and IRF (Immature reticulocyte fraction) and significance of reticulocyte Introduction, Mechanism of coagulation, Blood coagulation, Routine coagulation test, bleeding time, clotting time, Prothrombin time, Partial thromboplastin time, activated partial thromboplastin time	6	CO2
3	**Cell Injury and Cellular Adaptations** **Inflammation**	a) Normal Cell b) Cell Injury- types of cell injury, etiology of cell injury, morphology of cell injury, cellular swelling. c) Cell death: types- autolysis, necrosis, apoptosis & gangrene. d) Cellular adaptations-atrophy, hypertrophy, hyperplasia & dysplasia. b) Acute inflammation - vascular event, cellular event, inflammatory cells. b) Chronic Inflammation - general features, granulomatous inflammation, tuberculoma	6	CO3
4	**Hemodynamic Disorders** **Neoplasia**	Oedema, hyperemia, congestion, hemorrhage, circulatory disturbances, thrombosis, ischemia & infarction. Definition, how does it differ from hyperplasia, difference between benign tumor and malignant tumor	6	CO4
5	**Blood Banking**	Genetics of ABO blood group system. Red cell reagents and preparation of red cell suspension. Method of determination of ABO and Rh blood group. Other blood group system. Importance of blood grouping. Donor selection & rejection. Blood collection, anticoagulants and additive systems. COOMB's Test, HDN	6	CO5

Reference Books:

1. Godkar. B. Praful, (2016) Textbook of MLT,3rd edition, Bhalani Publications.
2. Singh Tejinder, (2014), Atlas & Textbook of Hematology, 3rd edition, Avichal Publications.
3. Ochei J & Kolhatkar A (2000), Medical Laboratory Science: Theory & Practice, 3rd edition, Mcgraw Hill Educatio
4. Mukherjee L.K. (2017), Medical Laboratory Technology, Vol.1-3, 3rd edition, Tata Mcgraw Hill.
5. Sood Ramnik, (2015), Text book of Medical Laboratory Technology, 2nd edition, Jaypee Publications.

e-Learning Source:
1. https://www.slideshare.net/peddanasunilkumar/introduction-to-pathology-ppt
2. https://www.ucsfhealth.org/medical-tests/semen-analysis#:~:text=Semen%20analysis%20is%20one%20of,have%20a%20male%20infertility%20problem
3. https://www.youtube.com/watch?v=wZCKrseSIOE

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	2	2	-	-	-	1	2	1	-	2	-	2	2	1	-
CO2	1	-	1	3	-	-	-	2	3	-	-	3	-	1	1	1	-
CO3	1	3	1	2	-	-	-	1	2	2	-	2	-	1	1	1	-
CO4	1	2	1	2	-	-	-	1	3	-	-	3	-	1	2	1	-
CO5	1	2	1	2	-	-	-	1	2	1	-	2	-	1	1	1	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT404	General Pathology And General Haematology And Blood Banking	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√	√	√	√	**3,4, 11**

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**LT405**	**Title of the Course**	**Research Methodology & Biostatistics 1**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**I**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The major objective of the course is to develop professional communication skills among the students.						

Course Outcomes	
CO1	The student will be taught about Research Methodology, Basic concept.
CO2	The student will be taught about Introduction of epidemiology, Screening, Sampling methods etc.
CO3	The student will be taught about Data- Research tools and Data collection methods
CO4	The student will be taught about literature review & writing Research proposals.
CO5	The student will be taught about statistical analysis.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Research Methodology**	Need for Research in Medical Laboratory science, Introduction to research methods, Conducting a literature review, Research design, Sampling methods, Data collection and data collection tools, Data analysis: Quantitative and Qualitatively, Public health research, Issues in Research. of research problems and writing research questions, Hypothesis, Null and Research Hypothesis, Type I and Type II errors in hypothesis testing	6	CO1
2	**Epidemiology**	Introduction of epidemiology, Descriptive epidemiology, Experimental and non-experimental research designs, Screening, Sampling methods, biological variability, normal distribution	5	CO2
3	**Research tools and Data collection**	Bias and Confounding, Association and causation, Odds ratio and relative risk, sensitivity and specificity Data collection methods- Observation method, Interview method, Questionnaires and schedules Construction	6	CO3
4	**Research writing**	Critical analysis of research papers, conducting a literature review, Writing Research proposals, Development of conceptual framework in research	6	CO4
5	**Statistical analysis**	Introduction to Statistics, Classification of data, Source of data, Method of scaling - nominal, ordinal, ratio and interval scale, measuring reliability and validity of scales, Measures of Central tendency, Measures of Dispersion, Skewness and kurtosis, Sampling, Sample size determination, Introduction and method of collecting and presenting of statistical data. Calculation and interpretation of various measures like mean, median, standard deviations, Skewness and Kurtosis, Probability distribution, Correlation and regression Significance tests and confidence intervals	6	CO5

Reference Books:

1. Statistical Methods by S.P. Gupta.
2. Methods in biostatistics for medical students by B.K.Mahajan..
3. RPG Biostatistics by Himanshu Tyagi.

e-Learning Source:

1. https://www.researchgate.net/publication/303381524_Fundamentals_of_research_methodology_and_data_collection
2. https://en.wikipedia.org/wiki/Biostatistics
3. https://www.nordp.org/what-is-research-development-

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	-
CO2	1	3	1	3	-	-	-	1	3	-	-	3	3	2	-	2	-
CO3	1	3	1	2	-	-	-	1	2	-	-	2	3	1	-	1	-
CO4	1	3	1	2	-	-	-	1	3	-	-	3	2	1	-	1	-
CO5	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	-

2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT405	Research Methadology & Biostatistics 1	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	-	√		-	√	√	**3,4, 11**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	**LT406**	**Title of the Course**	**General Biochemistry (Lab)**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**I**	**0**	**0**	**6**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The student will be able to demonstrate knowledge in clinical as needed for the study and practice of medical laboratory technology.						

Course Outcomes	
CO1	Students are able to perform test related to diabetic profile.
CO2	Students are able to perform all test related to Kidney function
CO3	Students are able to perform all test related to Liver function
CO4	Students are able to perform all test related to cholesterol profile
CO5	Students are able to perform all test related to cardiac profile.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Chemistry of Carbohydrates**	Important function, Properties of carbohydrates, GTT, Glycosylated haemoglobin, Diabetic profile test	60 hrs	CO1 - CO5
2	**Kidney Function Test** **Chemistry of proteins**	General Introduction, Urea estimation, Serum creatinine, Uric acid, Urea creatinine. Serum Protein, albumin & Globulin estimation		
3	**Enzymes** **Liver Function Test**	SGPT, Serum amylase, SGOT, Serum lipase Serum bilirubin, Alkaline phosphate determination		
4	**Chemistry of lipids**	Estimation of Serum total cholesterol, Serum triglycerides, HDL, LDL, VLDL		
5	**Cardiac profile test**	The heart, Ischemic heart disease, Atherosclerosis, Serum CK, LDH, apolipoprotein A-1, Lipoprotein		

Reference Books:

1. Fundamentals of Biochemistry-by Dr. Deb Jyoti Das
2. Biochemistry-by-Dr Satyanarayan.
3. Textbook of Biochemistry –Chatterje and Shinde.

e-Learning Source:

1. https://www.youtube.com/watch?v=9flJfhR_H_A
2. https://www.youtube.com/watch?v=0LceUS6pWtE
3. https://www.youtube.com/watch?v=yxhRT6zfFT8

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	1	2	1	-	2	-	1	2	-	3
CO2	2	3	2	2	-	-	-	1	3	1	-	3	-	2	1	-	2
CO3	1	3	1	2	-	-	-	1	2	-	-	2	-	1	2	-	3
CO4	2	3	1	2	-	-	-	1	3	-	-	3	-	2	3	-	3
CO5	1	3	1	2	-	-	-	1	2	1	-	2	-	1	2	-	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
LT406	General Biochemistry (Lab)	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	3,4

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	**LT407**	**Title of the Course**	**General Microbiology (Lab)**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**I**	**0**	**0**	**6**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	This subject gives a general insight into the history, basics of microbiology and impart knowledge about equipment used in microbiology.						

Course Outcomes	
CO1	Students are able to handle microscope and also know about sterlization & BWM.
CO2	Students are able to learn about culture method & staining method.
CO3	Students are able to learn about Biochemical tests for Bacterial identification
CO4	Students are able to perform Antibiotic susceptibility testing
CO5	Students are able to handle PCR machine.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Microscopy** **Sterilization, Antiseptics and disinfectants** **Biomedical waste management in a Medical Microbiology laboratory**	**Study and Handling of Binocular Microscope** Types and principles of sterilization methods, Heat (dry heat, moist heat with special Reference to autoclave) Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants Types of the waste generated – Segregation – Treatment – Disposal.	60 hrs	CO1-CO5
2	**Culture media and Stains**	Quality control in culture media, Automation in culture media preparation, Concepts, Methods Used for aerobic cultures, Methods used for anaerobic cultures, staining principle, Different stains used in bacteriology		
3	**Biochemical tests for Bacterial identification**	Identification of different bacteria: - Catalase, Coagulase, Indole, Methyl Red, Urease Citrate, Oxidase, TSIA, Nitrate reduction, Carbohydrate fermentation, Nagler's reaction, Cholera-red reaction		
4	**Antibiotic susceptibility testing in bacteriology**	Definition of antibiotics, Culture medium used for Antibiotic susceptibility testing, Various methods of Antibiotic susceptibility testing		
5	**Molecular methods in bacterial culture detection** **Preservation methods for microbes**	Polymerase chain reaction (PCR) Principle and procedures of various short term and long-term preservation methods.		

Reference Books:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
2. BrooksG.F.,CarrollK.C.,ButelJ.S.,MorseS.A.andMietzner,T.A.(2013).
3. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
4. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.
5. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

e-Learning Source:

1. https://www.babcock.edu.ng/oer/lecture_notes/mlsc/MLSC%20417%20HISTORY%20OF%20MICROBIOLOGY.ppt
2. https://www.tru.ca/__shared/assets/Microbiology_Lab_Safety39696.pdf
3. https://www.healthline.com/health/what-is-antiseptic

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	1	2	-	-	2	-	1	-	1	-
CO2	1	3	1	3	-	-	-	1	3	-	-	3	-	2	-	2	-
CO3	1	3	1	2	-	-	-	1	2	-	-	2	-	1	-	1	-
CO4	1	3	1	2	-	-	-	1	3	-	-	3	-	1	-	1	-
CO5	1	3	1	2	-	-	-	1	2	-	-	2	-	1	-	1	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT407	General Microbiology(Lab)	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√	-	√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2022							
Course Code	**LT408**	**Title of the Course**	**General Pathology and General Hematology and Blood Banking-Lab**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**I**	**0**	**0**	**6**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The students will be made aware of the General Pathology. In addition, they will understand Mechanism of disease, its Nature, processes, pathogenesis and accountability.						

Course Outcomes	
CO1	Students are able to perform Haemoglobin, ESR, PCV, GBP test
CO2	Students are able to diagnose morphology of blood cell & coagulation profile.
CO3	Students are able to perform Complete blood count
CO4	Students are able to perform different test used in blood banking.
CO5	Students are able to perform blood compatibility testing.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Blood** **Hemoglobin** **Hemocytometry** **Blood Film** **Erythrocyte Sedimentation Rate** **Packed Cell Volume**	Physiology of blood cells Methods to measure with merits and demerits, Absolute Values RBC count, WBC count, Platelet count Errors and Remedies Preparation, staining, Differential leucocyte count, Blood cell morphology, Normal and abnormal morphologies in malarial parasites, PBF in Filariasis. Estimation of ESR by Win Trobe's & Westergren's Methods. Estimation of ESR by automated Method. Introduction, Principle, Mechanism and different methods with merits and demerits for measuring PCV and its significance, Absolute values	60 hrs	CO1- CO5
2	**Red cell anomalies** **Reticulocytes** **Hemostasis**	Morphological changes such as variation in size shape & staining character Estimation of absolute reticulocyte count Routine coagulation test, bleeding time, clotting time, Prothrombin time, Partial thromboplastin time, activated partial thromboplastin time.		
3	**CBC**	Complete Blood Count		
4	**Blood Banking**	ABO blood group system Donor selection & rejection. Blood collection, anticoagulants and additive systems		
5	**Compatibility Test**	Coombs's test., Cross Matching		

Reference Books:

1. Godkar. B. Praful, (2016) Textbook of MLT,3rd edition, Bhalani Publications.
2. Singh Tejinder, (2014), Atlas & Textbook of Haematology, 3rd edition, Avichal Publications.
3. Ochei J & Kolhatkar A (2000), Medical Laboratory Science: Theory & Practice, 3rd edition, Mcgraw Hill Educatio
4. Mukherjee L.K. (2017), Medical Laboratory Technology, Vol.1-3, 3rd edition, Tata Mcgraw Hill.
5. Sood Ramnik, (2015), Text book of Medical Laboratory Technology, 2nd edition, Jaypee Publications.

e-Learning Source:

1. https://www.slideshare.net/peddanasunilkumar/introduction-to-pathology-ppt
2. https://www.ucsfhealth.org/medical-tests/semen-analysis#:~:text=Semen%20analysis%20is%20one%20of,have%20a%20male%20infertility%20problem
3. https://www.youtube.com/watch?v=wZCKrseSlOE

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	2	2	-	-	-	1	2	1	-	2	-	2	2	1	-
CO2	1	3	1	3	-	-	-	2	3	-	-	3	-	1	1	1	-
CO3	1	3	1	2	-	-	-	1	2	2	-	2	-	1	1	1	-
CO4	1	3	1	2	-	-	-	1	3	-	-	3	-	1	2	1	-
CO5	1	3	1	2	-	-	-	1	2	1	-	2	-	1	1	1	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
LT408	General Pathology And General Haematology And Blood Banking-Lab	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√	-	√	√	**3,4**

INTEGRAL UNIVERSITY, LUCKNOW

INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH

DEPARTMENT OF PARAMEDICAL SCIENCES

MASTER OF SCIENCE IN MEDICAL LABORATORY TECHNOLOGY
(M.Sc. MLT)

SYLLABUS

YEAR/ SEMESTER: I/II

Integral University, Lucknow Department of Paramedical Sciences

Study and Evaluation Scheme

Program: M.Sc. MLT Semester-II

S. N.	Course code	Course Title	Type of Paper	Period Per hr/week/sem			Evaluation Scheme				Sub. Total	Credit	Total Credits
				L	T	P	CT	TA	Total	ESE			
THEORIES													
1	LT409	Histopathology	Core	2	1	0	40	20	60	40	100	2:1:0	3
2	LT410	Cytopathology	Core	2	1	0	40	20	60	40	100	2:1:0	3
3	LT411	Principles Of Immunology	Core	2	1	0	40	20	60	40	100	2:1:0	3
4	LT412	Molecular Biology & Bioinformatics	Core	2	1	0	40	20	60	40	100	2:1:0	3
5	LT413	Research Methodology & Biostatistics 2	Core	2	1	0	40	20	60	40	100	2:1:0	3
PRACTICAL													
1	LT414	Histopathology-Lab	Core	0	0	6	40	20	60	40	100	0:0:6	3
	LT415	Cytopathology-Lab		0	0	6	40	20	60	40	100	0.0.6	3
2	LT416	Principles Of Immunology-Lab	Core	0	0	6	40	20	60	40	100	0:0:6	3
Total				**10**	**05**	**18**	**320**	**160**	**480**	**400**	**800**	**24**	**24**

S. N.	Course code	Course Title	Type of Paper	Attributes							United Nation Sustainable Development Goal (SDGs)
				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
THEORIES											
1	LT409	Histopathology	Core	√	√	√	√		√	√	3,4
2	LT410	Cytopathology	Core	√	√	√	√		√	√	3,4
3	LT411	Principles Of Immunology	Core	√	√	√	√		√	√	3,4
4	LT412	Molecular Biology & Bioinformatics	Core	√	√	√	√		√	√	3,4
5	LT413	Research Methodology & Biostatistics 2	Core	√	√	√	√		√	√	3,4
PRACTICAL											
1	LT414	Histopathology-Lab	Core	√	√	√	√		√	√	3,4
2	LT415	Cytopathology-Lab	Core	√	√	√	√		√	√	3,4
3	LT416	Principles Of Immunology-Lab	Core	√	√	√	√		√	√	3,4

L: Lecture **T:** Tutorials **P:** Practical **CT:** Class Test **TA:** Teacher Assessment **ESE:** End Semester Examination,

AE= Ability enhancement, DSE- Discipline Specific Elective, **Sessional Total:** Class Test + Teacher Assessment **Subject Total:** Sessional Total + End Semester Examination (ESE)

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**LT409**	**Title of the Course**	**Histopathology**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	2	1	0	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The curriculum of practical histopathology and its techniques aims to prepare the students to understand tolearn about handling and tissue processing and prepare to aid in proper diagnosis.						

Course Outcomes	
CO1	Students will be able to gain knowledge on histotechnology and different specimen types.
CO2	Students will be able to gain knowledge on safety measures in histopathology lab, Fixation techniques & Decalcification.
CO3	Students will be able to gain knowledge about tissues processing.
CO4	Students will be able to gain knowledge on microtomes & different stains.
CO5	Students will be able to gain knowledge on special stain & museum techniques.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction to Histotechnology**	Introduction, Compound microscope, Optical system, magnification and maintenance, Microscopy Working principle, Applications of various types of microscopes i.e., dark field, polarizing, phase contrast, interference and fluorescent microscope, Care and maintenance of laboratory equipment used in histotechnology, Safety measures in a histopathology laboratory, Hazards of biological specimens, biosafety and disposal of specimens. **Specimen types** Definition, Sources and types of cytological and histological specimens (Biopsy/Autopsy), Basic concepts about routine methods of examination of tissues, Collection and transportation of specimens for histological examination, grossing and specimen's management	6	CO1
2	**Fixatives and Fixation** **Decalcification**	1.Basic concepts of fixation, various types of fixatives used in a routine histopathology laboratory, Classification and composition of fixing fluids, Simple fixatives, Compound fixatives, Special fixatives for demonstration of various tissue elements. 2.Criteria of a good decalcification agent, Technique of decalcification followed with selection of tissue, fixation, and decalcification, neutralization of acid and thorough washing, Various types of decalcifying fluids: Organic & Inorganic Acid, chelating agents, Use of Ion-exchange resigns and Electrophoretic decalcification and treatment of hard tissues which are not calcified, Processing of various tissues for histological examination	6	CO2
3	**Tissue processing**	Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing, Components & principles of various types of automatic tissue Processors Embedding, Definition, Various types of embedding media	6	CO3
4	**Microtomes** **Staining**	Introduction regarding equipment used for sectioning, Microtome Knives, Sharpening of Microtome Knives, Honing, Stropping, various types of microtomes and their applications, Freezing Microtome and various types of Cryostats, care and maintenance, Faults in paraffin section cutting with errors and remedies, spreading the sections and attachment or mounting of sections to glass slides, techniques of attaching sections to slide from tissue floatation water bath. Theory of Staining, Classifications of Dyes, Principles of Dye Chemistry, Stains and Dyes and their uses Types of Stains, Chemical Staining Action, Mordants and Accentuators, Metachromasia, Use of Controls in Staining Procedures, Preparation of Stains, solvents, aniline water and buffers etc., Commonly used mountants in histotechnology lab, General Staining Procedures for Paraffin Infiltrated and Embedded tissue, Nuclear Stains and Cytoplasmic stains, Equipment and Procedure for manual Staining and Automatic Staining Technique, Mounting of Cover Slips, Labelling and Cataloguing the Slides, Routine Staining Procedures, Haematoxylin and Eosin Staining, various types of Haematoxylins, Mallory's Phosphotungstic Acid Haematoxylin (PTAH)	6	CO4
5	**Special stains** **Museum Techniques**	Introduction, types, preservation and their uses (PAS, reticulin, PTAH, Masson's trichrome, Mucin carmine, Calcium, VGE (VVG), Fite stain (Leprosy), AFB, Iron, Fat (Oil red O) Introduction, Museum specimen, Care of museum specimen, Preparation of fixative and mounting, solutions, mounting and after care of mounted specimen cataloguing of museum specimen, after care of mounted specimens	6	CO5

Reference Books:

1. Bancroft's Theory and Practice of Histological Techniques, 7th Edition, ElsevierPublications
2. Harshmohan (2017), Textbook of Pathology,7th edition, JaypeePublications.
3. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,BhalaniPublications.
4. CFA Culling, (1974), Handbook of Histopathological and Histochemical techniques: Including Museum Techniques, 3rd edition, Butter worth

e-Learning Source:

1. https://www.slideshare.net/DJASMINEPRIYA/histopathology-introduction
2. https://www.ijohsjournal.org/article.asp?issn=22316027;year=2018;volume=8;issue=2;spage=63;epage=67;aulast=Theresa
3. https://www.slideshare.net/VarugheseGeorge/hematoxylin-and-eosin-staining-67250220

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	1	1	1	-	3	2	2	1	1	1
CO2	1	3	2	2	-	-	-	1	1	1	-	3	2	2	1	1	1
CO3	1	3	1	2	-	-	-	1	1	1	-	3	2	1	1	1	1
CO4	2	3	1	2	-	-	-	1	1	1	-	3	2	2	1	1	1
CO5	1	3	1	2	-	-	-	1	1	1	-	3	2	1	1	1	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation Attributes & SDGs

Course Code	Course Title	Attributes							SDGs No.
LT108	HUMAN ANATOMY-II	Employability	Entrepreneurship	Skill	Gender	Environment &	Human	Professional	

				Development	Equality	Sustainability	Value	Ethics	
		√	√	√	√	-	√	√	3,4

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**LT410**	**Title of the Course**	**Cytopathology**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	2	1	0	**3**
Pre-Requisite	**Nil**	**Co-requisite**	Nil				
Course Objectives	The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures & amp; handling & testing of various cytological specimens.						

Course Outcomes	
CO1	The students will learn about cryostat sectionong & aspiration cytology.
CO2	The students will learn about exfoliative & fluid cytology
CO3	The students will learn about Urine & stool examination.
CO4	The students will learn about cerebrospinal fluid examination
CO5	The students will learn about different biological fluid and its cytology.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Cryostat sectioning**	Cryostat introduction, its applications in diagnostic cytopathology, Enzyme cytochemistry, Diagnostic applications, Demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases, Vital staining for Sex Chromatin	6	CO1
	Aspiration cytology	Introduction, Principle, Indications& utility of the technique with special emphasis on role of cytotechnologist in FNAC clinics		
2	**Exfoliative cytology,**	Papanicolaou technique for the staining of cervical smears) Introduction, Cervical cytology,	6	CO2
		Urine, CSF, Body Fluids (Pleural, Pericardial, Ascitic) Automation in cytology		
	Fluid Cytology	Liquid based cytology		
		Principles and preparation, Cytocentrifuge, molecular cytology, Cell Block and Immuno-cytochemistry.		
3	**Urine analysis**	Introduction, Physical characteristics and normal composition of urine and its proper collection and clinical importance of urine analysis, abnormal cytological constituents and identification in urine.	6	CO3
	Stool analysis	Introduction, Physical characteristics and normal composition of stool, its proper collection and clinical importance of stool analysis, abnormal constituents like blood- fresh and occult.		
4	**Cerebrospinal fluid**	Introduction, Physical characteristics and normal composition of CSF, clinical significance and cytological analysis of CSF	6	CO4
5	**Biological fluids**	Formation and composition of different biological fluids, transudates and exudates (Peritoneal, Pleural, synovial, ascites, Gastric juice etc.), clinical significance and cytological analysis of the above-mentioned fluids	6	CO5

Reference Books:

1. Medical Lab technology by Lynch.
2. An Introduction to Medical Lab Technology by F J Baker and Silverton
3. Bancroft's Theory and Practice of Histopathological Techniques by John D Bancroft.
4. Diagnostic Cytology by Koss Volume -II.
5. Handbook of Histopathological Techniques by C F A Culling.

e-Learning Source:

1 https://www.sciencedirect.com/topics/medicine-and-dentistry/cytopathology
2 https://www.thieme-connect.com/products/ejournals/pdf/10.1055/s-0039-1693098.pdf
3 https://www.slideserve.com/tevy/cytology-of-body-fluid

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	1
CO2	1	3	1	3	-	-	-	1	3	-	-	3	3	2	-	1	1
CO3	1	3	1	2	-	-	-	1	2	-	-	2	3	1	-	1	1
CO4	1	3	1	2	-	-	-	1	3	-	-	3	2	1	-	1	1
CO5	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT410	**Cytopathology**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	

						y			
		√	√	√	√	-	√	√	3,4

Integral University, Lucknow

Effective from Session: 2021-22							
Course Code	**LT411**	**Title of the Course**	**Principles Of Immunology**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	This course has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.						

Course Outcomes	
CO1	The students will learn scientific approaches/techniques that are used to investigate various diseases, historical background, general concepts of the immune system.
CO2	The students will learn scientific approaches/techniques that are used to investigate Laboratory tests for demonstration of antigen antibody reaction such as agglutination, precipitation, ELISA, RIA, Immune of fluorescence.
CO3	The students will learn scientific approaches/techniques that are used in complement system.
CO4	The students will learn about autoimmunity & hypersensitivity.
CO5	The students will learn in detail about vaccine schedule and types of vaccines.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**History and introduction to immunology**	Introduction, Immunity: Innate, Acquired immunity, Basic concepts about their mechanisms, Definition, types of antigens and determinants of antigenicity, Definition, types, structure and properties of immunoglobulin	6	CO1
	Antigen-Antibody reactions	Definition, Classification, General features and mechanisms, Applications of various antigen antibody reactions		
2	**Principle, procedure and applications of under mentioned in Medical Microbiology**	Complement fixation test, Immuno- fluorescence, ELISA, SDS-PAGE, Western blotting	6	CO2
	Principle, procedure and interpretation of various serological tests	WIDAL, VDRL, ASO, CRP, Brucella tube agglutination, Rose-Waaler		
3	**Complement system**	Definition, Basic concepts about its components, Complement activation pathways, Immune response: Introduction, Basic concepts of Humoral and Cellular immune responses	6	CO3
4	**Hypersensitivity**	Definition, Types of hypersensitivity reactions, Basic concepts of autoimmunity and brief knowledge about autoimmune diseases, Automation in diagnostic serology	6	CO4
5	**Vaccines**	Definition, Types, Vaccination schedule, Brief knowledge about Extended programme of immunization (EPI) in India	6	CO5

Reference Books:

1. Abbas AK, LichtmanAH, PillaiS.(2007).CellularandMolecularImmunology.6thedition Saunders Publication, Philadelphia.
2. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
3. Murphy K, Travers P, Walport M. (2008).Janeway's Immunobiology.7 th edition Garland Science Publishers, New York.
4. Delves P ,Martins,BurtonD,RoittIM.(2006).Roitt'sEssentialImmunology.11thedition Wiley- Blackwell Scientific Publication, Oxford.

e-Learning Source:

1. https://en.wikipedia.org/wiki/Immune_system
2. https://www.creative-diagnostics.com/blog/index.php/immunogen-antigen-hapten-epitope-and-adjuvant/
3. https://www.webmd.com/rheumatoid-arthritis/an-overview-of-rheumatic-diseases

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	-	2	1	-	-	-	1	1	-	1	2	1	3	2	1
CO2	1	3	-	2	-	-	-	-	1	-	-	1	2	1	3	2	1
CO3	2	3	-	2	-	-	-	-	1	1	-	1	2	1	3	2	1
CO4	1	3	-	1	-	-	-	-	1	-	-	1	2	1	3	2	1
CO5	2	3	-	1	-	-	-	-	1	-	-	1	2	1	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT411	**Principles Of Immunology**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	

						y			
		√	√	√	√	-	√	√	3,4

Integral University, Lucknow

Effective from Session: 2021-322							
Course Code	**LT412**	**Title of the Course**	**Molecular Biology & Bioinformatics**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	Nil				
Course Objectives	The students will learn about various histocompatibility & Hypersensitivity test also about different molecular techniques.						

Course Outcomes	
CO1	Students will learn about Immunology & immune system.
CO2	Students will learn about major histocompatibility complex & HLA test
CO3	Students will learn about Hypersensitivity & Autoimmunity.
CO4	Students will learn about molecular biology.
CO5	Students will learn about advance molecular techniques.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Immunology & immune system**	Introduction to Immunology Cells of the immune system Types and Mechanisms of immune response	6	CO1
2	**Histocompatibility**	Lymphoid organs of the Immune system MHC I& II HLA Typing	6	CO2
3	**Hypersensitivity & Autoimmunity**	Hypersensitivity: Definition, Types, Mechanisms Autoimmunity	6	CO3
4	**molecular biology**	Immune tolerance: Basic concepts Introduction to Molecular Biology	6	CO4
5	**advance molecular techniques**	Molecular Biology Techniques: Principle, Reagents used, procedure and applications in Medical diagnostics, Polymerase Chain Reaction and its advanced versions, Gel electrophoresis, Western blotting.	6	CO5

Reference Books:

1. Immunology by Kuby
2. Basic & clinical Immunology by P. Daniel Fudenberg.H. Hugh and stites
3. Advanced Molecular Biology by R. Twyman
4. Principal Of Biochemistry by Lehninger

e-Learning Source:

1. https://www.slideshare.net/doctortvrao/introduction-to-immunology-science-of-immunity
2. https://www.youtube.com/watch?v=yDAGxVxY-L8
3. **https://www.youtube.com/watch?v=8rAgLPb85N0&list=PLnOqvBJZU3IZwl7z58fWVTBzmd9OLURp9**

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	-
CO2	1	3	1	3	-	-	-	1	3	-	-	3	3	2	-	2	-
CO3	1	3	1	2	-	-	-	1	2	-	-	2	3	1	-	1	-
CO4	1	3	1	2	-	-	-	1	3	-	-	3	2	1	-	1	-
CO5	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT412	**Molecular Biology & Bioinformatics**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	3,4

Integral University, Lucknow

Effective from Session: 2015-16							
Course Code	**LT413**	**Title of the Course**	**Research Methodology & Biostatistics 2**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical sciences, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.						

Course Outcomes	
CO1	To learn about Introduction a revision.
CO2	To learn about sample size & hypothesis.
CO3	To learn about probability distributions.
CO4	To learn about correlation method.
CO5	To learn about parametric and non parametric test & ANOVA.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Introduction and revision**	Introduction to Statistics, Classification of data, Source of data, Method of scaling - nominal, ordinal, ratio and interval scale, measuring reliability and validity of scales	6	CO1
2	**Sample size & hypothesis.**	Measures of Central tendency, Measures of Dispersion, Skewness and kurtosis, Sampling, Sample size determination, Testing hypothesis- Chi - Square test, Student's t test, ANOVA.	6	CO2
3	**probability**	Concept of probability and Probability distributions – Binomial Probability distribution, Poisson Probability distribution and Normal Probability distribution	6	CO3
4	**Correlation method**	Correlation-Karl Person, Spearman's Rank correlation methods, Regression Analysis	6	CO4
5	**Parametric tests** **ANOVA** **Non parametric tests**	a. Test for single Proportion b. Test for equality of Proportion c. Test for single mean Test for equality of means One way Two ways a. Chi-squaretests b. Fisher's exacttest c. McNemartest d. Mann-whitneyU-test e. Mediantest f. Signtest g. Wilcoxontes	6	CO5

Reference Books:

1. Statistical Methods by S.P. Gupta.
2. Methods in biostatistics for medical students by B.K.Mahajan..
3. RPG Biostatistics by Himanshu Tyagi.

e-Learning Source:

1. https://www.researchgate.net/publication/303381524_Fundamentals_of_research_methodology_and_data_collection
2. https://en.wikipedia.org/wiki/Biostatistics
3. https://www.nordp.org/what-is-research-development-

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	-
CO2	1	3	1	3	-	-	-	1	3	-	-	3	3	2	-	2	-
CO3	1	3	1	2	-	-	-	1	2	-	-	2	3	1	-	1	-
CO4	1	3	1	2	-	-	-	1	3	-	-	3	2	1	-	1	-
CO5	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	-

3- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT413	**Research Methodology & Biostatistics 2**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	

		√	-	√	√	-	√	√	3,4, 11

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	**LT414**	**Title of the Course**	**Histopathology (Lab)**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	0	0	6	3
Pre-Requisite	**NIL**	**Co-requisite**	**Nil**				
Course Objectives	The curriculum of practical histopathology and its techniques aims to prepare the students to understand to learn about handling and tissue processing and prepare to aid in proper diagnosis.						

Course Outcomes	
CO1	Students will be able to gain knowledge on histotechnology and different specimen types.
CO2	Students will be able to gain knowledge on safety measures in histopathology lab, Fixation techniques & Decalcification.
CO3	Students will be able to gain knowledge about tissues processing.
CO4	Students will be able to gain knowledge on microtomes & different stains.
CO5	Students will be able to gain knowledge on special stain & museum techniques.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Histotechnology**	Introduction, Compound microscope, Optical system, magnification and maintenance, Microscopy Working principle, Applications of various types of microscopes i.e., dark field, polarizing, phase	60 hrs	CO1
	Specimen types	Definition, Sources and types of cytological and histological specimens (Biopsy/Autopsy), Basic concepts about routine methods of examination of tissues, Collection and transportation of specimens for histological examination, grossing and specimen's management		
2	**Fixatives and Fixation**	Various types of fixatives used in a routine histopathology laboratory, Classification and composition of fixing fluids, Simple fixatives, Compound fixatives, Special fixatives for demonstration of various tissue elements		CO2
	Decalcification	Technique of decalcification followed with selection of tissue, fixation, and decalcification, neutralization of acid and thorough washing, Various types of decalcifying fluids		
3	**Tissue processing**	Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing, Components & principles of various types of automatic tissue Processors Embedding, Definition, Various types of embedding media		CO3
4	**Microtomes**	Microtome, Microtome Knives, Sharpening of Microtome Knives, Honing, Stropping, Freezing Microtome and various types of Cryostats		CO4
	Staining	Routine Staining Procedures, Haematoxylin and Eosin Staining, various types of Haematoxylins, Mallory 's Phosphotungstic Acid Haematoxylin (PTAH)		
5	**Special stains**	PAS, reticulin, PTAH, Masson's trichrome, Mucin carmine, Calcium, VGE (VVG), Fite stain (Leprosy), AFB, Iron, Fat (Oil red O) Care of museum specimen, Preparation of fixative and mounting, solutions.		CO5
	Museum Techniques	Course References: 1. Bancroft's Theory and Practice of Histological Techniques, 7th Edition, Elsevier Publications 2. Harshmohan (2017), Textbook of Pathology,7th edition, Jaypee Publications 3. Godkar.B. Praful, (2016) Textbook of MLT,3rdedition, Bhalani Publications 4. C F A Culling, (1974), Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques,3rd edition, Butterworths Publishers		

Reference Books:

1. Bancroft's Theory and Practice of Histological Techniques, 7th Edition, ElsevierPublications
2. Harshmohan (2017), Textbook of Pathology,7th edition, JaypeePublications.
3. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,BhalaniPublications.
4. CFA Culling, (1974), Handbook of Histopathological and Histochemical techniques: Including Museum Techniques, 3rd edition, Butter worth

e-Learning Source:

1. https://www.slideshare.net/DJASMINEPRIYA/histopathology-introduction
2. https://www.ijohsjournal.org/article.asp?issn=22316027;year=2018;volume=8;issue=2;spage=63;epage=67;aulast=Theresa
3. https://www.slideshare.net/VarugheseGeorge/hematoxylin-and-eosin-staining-67250220

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	1	1	1	-	3	2	2	1	1	1
CO2	1	3	2	2	-	-	-	1	1	1	-	3	2	2	1	1	1
CO3	1	3	1	2	-	-	-	1	1	1	-	3	2	1	1	1	1
CO4	2	3	1	2	-	-	-	1	1	1	-	3	2	2	1	1	1
CO5	1	3	1	2	-	-	-	1	1	1	-	3	2	1	1	1	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT414	**Histopathology (Lab)**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	

						y			
		√	√	√	√	-	√	√	3,4

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	**LT415**	**Title of the Course**	**Cytopathology (Lab)**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	0	0	6	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	**The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures & amp; handling & testing of various cytological specimens.**						

Course Outcomes	
CO1	The students will learn about cryostat sectionong & aspiration cytology.
CO2	The students will learn about exfoliative & fluid cytology
CO3	The students will learn about Urine & stool examination.
CO4	The students will learn about cerebrospinal fluid examination
CO5	The students will learn about different biological fluid and its cytology.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Cryostat sectioning** **Aspiration cytology**	Demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases, Vital staining for Sex Chromatin FNAC	60 hrs	CO1 - CO5
2	**Exfoliative cytology** **Fluid Cytology**	(Papanicolaou staining) Cervical cytology Urine, CSF, Body Fluids (Pleural, Pericardial, Ascitic)		
3	**Urine analysis** **Stool analysis**	Urine Examination (Microscopic) Stool Examination (Microscopic)		
4	**Cerebrospinal fluid**	CSF		
5	**Biological fluids**	Cytological analysis of Peritoneal, Pleural, synovial, ascites, Gastric juice etc		

Reference Books:

1. Medical Lab technology by Lynch.
2. An Introduction to Medical Lab Technology by F J Baker and Silverton
3. Bancroft 's Theory and Practice of Histopathological Techniques by John D Bancroft.
4. Diagnostic Cytology by Koss Volume -II.
5. Handbook of Histopathological Techniques by C F A Culling.

e-Learning Source:

1 https://www.sciencedirect.com/topics/medicine-and-dentistry/cytopathology

2 https://www.thieme-connect.com/products/ejournals/pdf/10.1055/s-0039-1693098.pdf

3 https://www.slideserve.com/tevy/cytology-of-body-fluid

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	1
CO2	1	3	1	3	-	-	-	1	3	-	-	3	3	2	-	1	1
CO3	1	3	1	2	-	-	-	1	2	-	-	2	3	1	-	1	1
CO4	1	3	1	2	-	-	-	1	3	-	-	3	2	1	-	1	1
CO5	1	3	1	2	-	-	-	1	2	-	-	2	2	1	-	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT415	**Cytopathology (Lab)**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	

		√	√	√	√	-	√	√	3,4

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	**LT416**	**Title of the Course**	**Principles Of Immunology (Lab)**	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	0	0	6	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	This course has been formulated to impart basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases.						

Course Outcomes: After the successful course completion, learners will develop following attributes:	
CO1	The students will learn scientific approaches/techniques that are used to investigate various diseases, historical background, general concepts of the immune system
CO2	The students will learn scientific approaches/techniques that are used to investigate Laboratory tests for demonstration of antigen antibody reaction such as agglutination, precipitation, ELISA, RIA, Immune of fluorescence.
CO3	The students will learn scientific approaches/techniques that are used in complement system.
CO4	The students will learn about autoimmunity & hypersensitivity.
CO5	The students will learn in detail about vaccine schedule and types of vaccines.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**History and introduction to immunology, Antigen-Antibody reactions, Principle, procedure and applications of under mentioned in Medical Microbiology, Principle, procedure and interpretation of various serological tests Complement system, Hypersensitivity, Vaccines**	ELISA SDS-PAGE WESTERN BLOTTING WIDAL VDRL ASO CRP BRUCELLA TUBE AGGLUTINATION ROSE-WAALER	60 hrs	CO1 - CO5

Reference Books:

1. Abbas AK, LichtmanAH, PillaiS.(2007).CellularandMolecularImmunology.6thedition Saunders Publication, Philadelphia.
2. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
3. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology.7 th edition Garland Science Publishers, New York.
4. Delves P, Martins, BurtonD,RoittIM.(2006).Roitt'sEssentialImmunology.11thedition Wiley- Blackwell Scientific Publication, Oxford.

e-Learning Source:

1. https://en.wikipedia.org/wiki/Immune_system
2. https://www.creative-diagnostics.com/blog/index.php/immunogen-antigen-hapten-epitope-and-adjuvant/
3. https://www.webmd.com/rheumatoid-arthritis/an-overview-of-rheumatic-diseases

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	-	2	1	-	-	-	1	1	-	1	2	1	3	2	1
CO2	1	3	-	2	-	-	-	-	1	-	-	1	2	1	3	2	1
CO3	2	3	-	2	-	-	-	-	1	1	-	1	2	1	3	2	1
CO4	1	3	-	1	-	-	-	-	1	-	-	1	2	1	3	2	1
CO5	2	3	-	1	-	-	-	-	1	-	-	1	2	1	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LT416	**Principles Of Immunology (Lab)**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√	-	√	√	**3,4**