INTEGRAL UNIVERSITY, LUCKNOW

INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH

DEPARTMENT OF PARAMEDICAL SCIENCES

MASTER OF MEDICAL LABORATORY SCIENCES (MMLS)

SYLLABUS

YEAR/ SEMESTER: II/III

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

Program: MMLS Semester-III

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	LS601	Clinical Biochemistry, Endocrinology & Nutritional Biochemistry	Core	2	1	0	40	20	60	40	100	2:1:0	3
2	LS602	Systemic Bacteriology, Virology & Mycology	Core	2	1	0	40	20	60	40	100	2:1:0	3
3	LS603	Advanced Hematology and Immuno Hematology	Core	2	1	0	40	20	60	40	100	2:1:0	3
PRACTICAL													
4	LS604	Seminars	Core	2	1	0	40	20	60	40	100	2:1:0	3
5	LS605	Clinical Biochemistry, Endocrinology & Nutritional Biochemistry- Lab	Core	0	0	6	40	20	60	40	100	0:0:6	3
6	LS606	Systemic Bacteriology, Virology and mycology - Lab	Core	0	0	6	40	20	60	40	100	0:0:6	3
7	LS607	Advanced Hematology and Immuno Hematology - Lab	Core	0	0	6	40	20	60	40	100	0:0:6	3
Total				**8**	**4**	**18**	**280**	**140**	**420**	**280**	**700**	**21**	**21**

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	LS601	Clinical Biochemistry, Endocrinology & Nutritional Biochemistry	Core	√	√	√	√		√	√	3,4
2	LS602	Systemic Bacteriology, Virology & Mycology	Core	√	√	√	√		√	√	3,4
3	LS603	Advance Hematology & Immunology	Core	√	√	√	√		√	√	3,4
PRACTICAL											
4	LS604	Seminars	Core	√	√	√	√		√	√	3,4
5	LS605	Clinical Biochemistry, Endocrinology & Nutritional Biochemistry- Lab	Core	√	√	√	√		√	√	3,4
6	LS606	Systemic Bacteriology, Virology and mycology - Lab	Core	√	√	√	√		√	√	3,4
7	LS607	Advanced Hematology and Immune Hematology - 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:2024-25							
Course Code	**LS601**	**Title of the Course**	**CLINICAL BIOCHEMISTRY, ENDOCRINOLOGY & NUTRITIONAL BIOCHEMISTRY**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	III	**2**	**1**	**0**	**3**
Pre-Requisite	Nil	**Co-requisite**	Nil				
Course Objectives	**The students will learn about various Biomolecules there Classification, Sites of Secretion, Mechanism of action, and reference ranges.**						

Course Outcomes	
CO1	Students are able to learn about clinical enzymology.
CO2	Students are able to learn about Disorders of carbohydrate metabolism.
CO3	Students are able to learn about Disorders of Lipid & proteins.
CO4	Students are able to learn about thyroid & parathyroid gland.
CO5	Students are able to learn about Nutritional requirement of carbohydrate and vitamins.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Enzymology**	Clinical Enzymology: Enzymes in plasma and their origin, general principles of assay, clinical significance of enzymes and iso-ezymes, Measurement of serum enzymes in diagnosis – cardiac and skeletal muscle enzymes, liver and biliary tract enzymes digestive, bone and its disorders.	6	CO1
2	**Disorders of carbohydrate metabolism**	Disorders of carbohydrate metabolism: diabetes mellitus – diagnosis, gestational diabetes mellitus, role of laboratory in diagnosis and prognosis, hypoglycemia. Determination of glucose in body fluids, ketone bodies, lactate and pyruvate. Glycated proteins, urinary albumin excretion Specimen collection, storage and quantitative assay. Qualitative tests for individual sugars in urine. Inborn errors of metabolism	6	CO2
3	**Disorders of Lipid and Protein Metabolism**	Disorders of Lipid Metabolism: Atherosclerosis and coronary artery disease. Disorders of lipoprotein metabolism. Measurement of lipids, lipoproteins and apolipoproteins. Sources of analytical and biological variations in measurements. Disorders of protein metabolism: plasma proteins, proteins in body fluids. Analysis of proteins in blood and other body fluids. Electrophoresis of plasma proteins. Aminoacidurias-selected disorders of amnoacid metabolism-phenylalanine, tyrosine, alkaptonuria, melanuria, cystinula, homocystinuria, cystinosis, organic acidurias. Analysis of amino acids – screening test, quantitative tests for specific amino acids. Hypothalamus and pituitary- anatomy, chemistry, functions, regulation. Diseases related to the hormones of these glands. Assessment of anterior and posterior pituitary.	6	CO3
4	**Thyroid**	Thyroid anatomy, chemistry, synthesis, functions, regulation, thyroid function test in various abnormal conditions, parathyroid – anatomy, chemistry, synthesis, functions, regulations, diseases of parathyroid glands. Hormones involved in calcium and phosphate metabolism. Diseases related to its metabolism. Calcium chemistry and functions.	6	CO4
5	**Nutritional Requirement**	Nutritional requirements of carbohydrates, proteins and lipids. Deficiency states of carbohydrates, proteins and lipid. RDA, Nutritional requirements of vitamins (fat and water soluble)- Structure, functions, deficiency states, dietary source, Nutritional requirements of macro and microelements-functions, deficiency states, dietary source.	6	CO5

Reference Books:

1. D M Vasudevan, (2011), Text book of Medical Biochemistry,6th edition Jaypee Publishers
2. M N Chatterje& Rana Shinde, (2012), Text book of Medical Biochemistry,8th edition, Jaypee Publications
3. Singh &Sahni, (2008), Introductory Practical Biochemistry,2nd edition, Alpha science
4. Lehninger, (2013), Principles of Biochemistry,6th edition, W H Freeman
5. U Satyanarayan, (2008), Essentials of Biochemistry,2nd edition, Standard Publishers
6. Sood Ramnik(2014), Textbook of Medical Laboratory Technology, Jaypee Publishers.

e-Learning Source:

1. https://byjus.com/biology/hormones/
2. https://docs.google.com/presentation/d/11DhZilsAs_n_hte5NqSQ30TV1RnMQOk5/edit?usp=share_link&ouid=116700992000575491834&rtpof=true&sd=true
3. https://www.slideshare.net/TSOLEMAN/1-introduction-15583147

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	PSO4	PSO5	PSO6	PSO7
CO1	2	3	-	2	1	-	-	-	1	1	-	1	2	1	3	2	1	2
CO2	1	3	-	2	-	-	-	-	1	-	-	1	2	1	3	2	1	1
CO3	2	3	-	2	-	-	-	-	1	1	-	1	2	1	3	2	1	2
CO4	1	3	-	1	-	-	-	-	1	-	-	1	2	1	3	2	1	1
CO5	2	3	-	1	-	-	-	-	1	-	-	1	2	1	3	2	1	2

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

Course Code	Course Title	Attributes							SDGs No.
LS601	**Clinical Biochemistry, Endocrinology & Nutritional Biochemistry**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√	√	√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	**LS602**	**Title of the Course**	**SYSTEMIC BACTERIOLOGY, VIROLOGY & MYCOLOGY**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**III**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	**The Students will get brief understanding about various types of medically important Bacteria, Fungi, Viruses and their associated disease and its Diagnosis.**						

Course Outcomes	
CO1	Students are able to learn about Gram positive cocci and Gram-negative cocci.
CO2	Students are able to learn about Gram positive & negative bacilli.
CO3	Students are able to learn about spirochetes
CO4	Students are able to learn about different viruses.
CO5	Students are able to learn about fungal infection.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Gram positive & negative cocci**	Gram positive cocci- staphylococci, pneumococci, streptococci Gram Negative cocci – N. Gonorrhea, N. meningitides	6	CO1
2	**Gram positive & negative bacilli**	Gram positive bacilli- corynebacteria, Mycobacteria, Clostridia, Actinomycetes Bacillus Anaerobes Gram negative bacilli – Enterobactericeae, Pseudomonas, Vibrio Brucella, Bordetella, Haemophilus, Yersinia	6	CO2
3	**Spirochetes and Miscellaneous Bacteria**	Spirochetes – Treponema, Leptospira, Miscellaneous bacteria. Classification Borrelia Rickettsiae, Chlamydiae, Mycoplasma	6	CO3
4	**Viruses**	General properties of viruses – Cultivation of viruses and laboratory diagnostic methods of viral diseases. Pox virus, herpes virus, myxoviruses, enteroviruses, interferon, inclusion bodies. Rabies, Arbo viruses, hepatitis, HIV, viruses causing gastro enteritis, miscellaneous viruses.	6	CO4
5	**Fungal Infections**	General properties of fungi, cultivation methods, laboratory methods of diagnosing fungal infection Superficial and deep fungal infections, opportunistic fungal infection and Mycotoxins	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., Carroll K.C., ButelJ.S.,MorseS.A.and Mietzner,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://slideplayer.com/slide/9041398/
2. https://www.webmd.com/a-to-z-guides/difference-between-gram-positive-bacillus-gram-negative-bacillus
3. https://www.ncbi.nlm.nih.gov/books/NBK7885/

	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.**
LS602	**Systemic Bacteriology, Virology & Mycology**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	**LS603**	**Title of the Course**	Advanced Hematology and Immuno Hematology	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**III**	**2**	**1**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The hematology curriculum aims to prepare students in advance disorders related to blood and stool and urine and their laboratory diagnosis and also about blood banking. Students would also be introduced to Quality Control and Quality Assurance.						

Course Outcomes: After the successful course completion, learners will develop following attributes:	
CO1	Students will learn about automated cell counter & analyzer.
CO2	Students will learn about urine & stool examination.
CO3	Students will learn about compatibility testing.
CO4	Students will learn about Apheresis technique and also about HDN.
CO5	Students will learn about HLA antibody.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Cell Counter, Transfusion Medicine Compatibility testing, Apheresis & HDN, HLA**	1. Automated cell counters and coagulation analyzers 2. Manual tests of coagulation factor 3. Peripheral smear –Preparation and Interpretation	6	CO1
2		1. Automation in Transfusion Medicine 2. Blood substitutes 3. Calibration, validation and maintenance of blood bank equipment, Quality Control of blood bank techniques, internal and external Quality Control.	6	CO2
3		1. Compatibility testing, Antibody screening and identification, clinical significance of choice of reagents. 2. International Society of Blood Transfusion and National AIDS Control Organization guidelines in Transfusion Medicine.	6	CO3
4		• Apheresis • Infectious disease screening • Transfusion reactions • Hemolytic Disease of the New born	6	CO4
5		1. Basics of HLA typing and anti HLA antibody detection	6	CO5

Reference Books:

1. Godkar B' Praful (2016): Textbook of Medical laboratory Technology (3rd edition) Bhalani Publications.
2. Sood Ramnik (2015): Medical Laboratory Technology: Methods and Interpretations (vol - 1 &2).
3. Kawthalkar, Shrish M: Essential of Clinical Pathology.
4. Singh Tejinder (2014): Atlas &Textbook of Hematology (3rd edition), Avichal Publications.

e-Learning Source:

1. https://www.slideshare.net/peddanasunilkumar/introduction-to-pathology-ppt
2. http://nbtc.naco.gov.in/assets/resources/training/25.pdf
3. https://www.transfusionguidelines.org/red-book/chapter-16-hla-typing-and-hla-serology.pdf

	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-

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

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LS603	**Advance Haematology & Immunology**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	**LS604**	**Title of the Course**	**SEMINARS**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**III**	**0**	**3**	**0**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	This course will serve as a platform for students to integrate various instrument and technique use in pathology lab in various departments.						

Course Outcomes	
CO1	The students will understand and interpret latest advancements through different technical papers, reports, Journals, Data sheets, books etc
CO2	The students will inculcate the skills for literature survey and will learn to manage resources effectively.
CO3	The students will be able to summarize the recent research and technologies in the form of review and will be able to deliver power point presentations on an assigned topic.
CO4	The students will be able to communicate his/her ideas with his peers as audience, which will enhance both oral and written communication skills.
CO5	The students will be able to create interest to pursue lifelong learning.

SEMINAR PRESENTATION ASSESSMENT FORM

Name of Student:		**Session:**	
Enrollment Number:		**Date:**	
Name of Subject:	Seminar	**Subject code:**	LS604
Topics:			

Criteria	Sub-Criteria	Max. Marks	Marks Obtained
Introduction (Max marks-18)	Use appropriate background information	**06**	
	Has clear statement of purpose	**06**	
	Shows a logical sequence	**06**	
Factual Content (Max marks- 42)	Includes accurate information	**06**	
	Shows up-to-date content	**06**	
	Presents relevant content	**06**	
	Shows in-depth and sufficient details	**06**	
	Addresses all important issues	**06**	
	Is selective	**06**	
	Use of proper English Grammar in the text	**06**	
Presentation Quality (Max marks-12)	Has a good design of presentation (appropriate font, type, size, color, matter per slide etc.)	**06**	
	Has a clear verbal expression and eye contact with audience	**06**	
Response to questions (Max marks-18)	Answers question(s) correctly	**06**	
	Has the ability to think on the spot	**06**	
	Shows an ability to defend content of presentation	**06**	
Time Management (Max. mark-10)	Completes the presentation within allocated time	**10**	
	Total Marks	**100**	

Note: In case of Oral Presentation, each student will be assessed in a 20 minutes time (15 min for presentation & 5 min for discussion) out of 100 marks.

Comments/Suggestions:

(Name and signature of Incharge) **(Head, Paramedical)**

	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

2-

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

Course Code	Course Title	Attributes							SDGs No.
LS604	**Seminars**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	**3,4**
		√	√	√	√		√	√	

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	**LS605**	**Title of the Course**	**CLINICAL BIOCHEMISTRY, ENDOCRINOLOGY & NUTRITIONAL BIOCHEMISTRY- LAB**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**III**	**0**	**0**	**6**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	**The students will learn about various Tools and Techniques to estimate the range of different types of Biomolecules.**						

Course Outcomes: After the successful course completion, learners will develop following attributes:	
CO1	Students are able to learn about clinical enzymology.
CO2	Students are able to learn about Disorders of carbohydrate metabolism.
CO3	Students are able to learn about Disorders of Lipid & proteins.
CO4	Students are able to learn about thyroid & parathyroid gland.
CO5	Students are able to learn about Nutritional requirement of carbohydrate and vitamins.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Procedures using automated analyzers**	1. Estimation of blood glucose, GT, Glycated hemoglobin, fructosamine, urine microalbumin. 2. RFT- Estimation of blood urea, serum creatinine, uric acid, GFR, urinary proteins, protein,Creatinine ratio. 3. LFT – Estimation of total bilirubin, total protein, albumin, SGOT, SGPT, ALP, GGT 4. Lipid profile- total cholesterol, triglycerides, HDL, LDL 5. Cardiac enzymes – creatinine kinase, CK- MB, LDH 6. Pancreatic function tests – amylase. 7. Estimation of calcium, phosphorous, magnesium, iron 8. Electrolytes 9. Quantitative analysis of urine- protein, uric acid, creatinine, calcium chloride 10. Analysis of CSF 11. Hormones: Thyroid profile- FT2, FT4, TSH, Fertility profile – LH, FSH, prolactin, estradiol,testosterone; cortisol, insulin 12. Tumor markers: P:SA 13. CAD risk assessment: Apo A, Apo B 100, hs Homocysteine, Lp(a)	60hrs	CO1-CO5

Reference Books:

6. . D M Vasudevan, (2011), Text book of Medical Biochemistry,6th edition Jaypee Publishers
7. M N Chatterjee & Rana Shinde, (2012), Text book of Medical Biochemistry,8th edition, Jaypee Publications
8. Singh &Sahni, (2008), Introductory Practical Biochemistry,2nd edition, Alpha science
9. Lehninger, (2013), Principles of Biochemistry,6th edition, W H Freeman
10. U Satyanarayan, (2008), Essentials of Biochemistry,2nd edition, Standard Publishers
6.Sood Ramnik(2014), Textbook of Medical Laboratory Technology, Jaypee Publishers.

e-Learning Source:

4. https://byjus.com/biology/hormones/
5. https://docs.google.com/presentation/d/11DhZilsAs_n_hte5NqSQ30TV1RnMQOk5/edit?usp=share_link&ouid=116700992000575491834&rtpof=true&sd=true
6. https://www.slideshare.net/TSOLEMAN/1-introduction-15583147

	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	-

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

Attributes & SDGs

Course Code	**Course Title**	**Attributes**							**SDGs No.**
LS605	**ClinicalBiochemisty, Endocrinology & Nutritional Biochemistry-Lab**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	**LS606**	**Title of the Course**	**SYSTEMIC BACTERIOLOGY, VIROLOGY AND MYCOLOGY - LAB**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**III**	**0**	**0**	**6**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	**The students will learn about various Culture Techniques to isolate the microorganism from different type of clinical specimens and identification of bacteria by biochemical testing.**						

Course Outcomes	
CO1	Students are able to learn about Gram positive cocci and Gram-negative cocci.
CO2	Students are able to learn about Gram positive & negative bacilli.
CO3	Students are able to learn about spirochetes
CO4	Students are able to learn about different viruses.
CO5	Students are able to learn about fungal infection.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Gram positive & negative cocci, Gram positive & negative bacilli, Spirochetes, Viruses, fungal infections**	1. Introduction of Clinical specimen, identification of bacteria, staining methods. Biochemical tests (IMViC), antibiotic sensitivity testing. 2. Darkground microscopy, special staining methods. 3. Isolation of Microorganism from Urine and Stool. 4. Identification of fungi, microscopy, culture, special staining methods. 5. Virus Cultivation Techniques. 6. Air Sampling and theatre sterility.	60 hrs.	CO1-CO5

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
2. Brooks G.F., Carroll K.C., ButelJ.S., MorseS.A.and Mietzner,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://slideplayer.com/slide/9041398/
2. https://www.webmd.com/a-to-z-guides/difference-between-gram-positive-bacillus-gram-negative-bacillus
3. https://www.ncbi.nlm.nih.gov/books/NBK7885/

	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.**
LS606	**Systemic Bacteriology,Virology and mycology - Lab**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	**LS607**	**Title of the Course**	**ADVANCED HEMATOLOGY AND IMMUNE HEMATOLOGY - LAB**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**III**	**0**	**0**	**6**	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The hematology curriculum aims to prepare students in advance Hematological disorders and their laboratory diagnosis and also about blood banking. Students would also be introduced to laboratory instrumentation, techniques and methods of estimating different parameters of blood and their clinical significance.						

Course Outcomes	
CO1	Students will learn about automated cell counter & analyzer.
CO2	Students will learn about urine & stool examination.
CO3	Students will learn about compatibility testing.
CO4	Students will learn about Apheresis technique and also about HDN.
CO5	Students will learn about HLA antibody.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Cell Counter, Transfusion Medicine, Compatibility testing, Apheresis & HDN, HLA**	1. Quality Control of Hematology Analyzer 2. Identification of Flags in Hematology Analyzers and their Redrassal. 3. How to validate the result of Hematology Analyzer 4. Adverse transfusion reaction workup 5. Apheresis Equipment 6. Automation in Compatibility Testing	60 hrs.	CO1- CO5

Reference Books:

1. Godkar B' Praful (2016): Textbook of Medical laboratory Technology (3rd edition) Bhalani Publications.
2. SoodRamnik (2015): Medical Laboratory Technology: Methods and Interpretations (vol - 1 &2).
3. Kawthalkar, Shrish M: Essential of Clinical Pathology.
4. Singh Tejinder (2014): Atlas & Textbook of Hematology (3rd edition), Avichal Publications.

e-Learning Source:

1. https://www.slideshare.net/peddanasunilkumar/introduction-to-pathology-ppt
2. http://nbtc.naco.gov.in/assets/resources/training/25.pdf
3. https://www.transfusionguidelines.org/red-book/chapter-16-hla-typing-and-hla-serology.pdf

	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.**
LS607	**Advanced Haematology And Immuno Haematology - 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 MEDICAL LABORATORY SCIENCES (MMLS)

SYLLABUS

YEAR/ SEMESTER: II/IV

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

Program: MMLS Semester-IV

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	LS608	Cytogenetics & Molecular Diagnosis	Core	3	1	0	40	20	60	40	100	2:1:0	4
2	LS610	Seminars	Core	0	5	0	40	20	60	40	100	0:5:0	5
3	LS611	Dissertation	Core	0	0	30	40	20	60	40	100	2:1:0	15
PRACTICAL													
5	LS609	Cytogenetics & Molecular Diagnosis - Lab	Core	0	0	6	40	20	60	40	100	0:0:6	3
Total				**3**	**6**	**36**	**160**	**80**	**240**	**160**	**400**	**27**	**27**

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	LS608	Cytogenetics & Molecular Diagnosis	Core	√	√	√	√		√	√	3,4
2	LS610	Seminars	Core	√	√	√	√		√	√	3,4
3	LS611	Dissertation	Core	√	√	√	√		√	√	3,4
PRACTICAL											
5	LS609	Cytogenetics & Molecular Diagnosis - 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: 2024-25							
Course Code	**LS608**	**Title of the Course**	**CYTOGENETICS & MOLECULAR DIAGNOSIS**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**IV**	3	1	0	**4**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	**1.** To develop the understanding about the concepts Cytogenetics. **2.** To understand Chromosomes, DNA Structure and Its replication in Health and Disease. **3.** To Understand the Tools and Techniques use in Molecular Diagnosis.						

Course Outcomes	
CO1	Students are able to learn about structural aspects of nucleic acid.
CO2	Students are able to learn about structure and morphology of chromosome.
CO3	Students are able to learn about different molecular techniques.
CO4	Students are able to learn about body fluid examinations.
CO5	Students are able to learn about different process of nucleic acid.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Nucleic acid, Chromosome, Molecular Techniques,**	Nucleic acid: Structural aspects – Components of DNAand RNA, Nucleosides & Nucleotides (introduction, structure & bonding), Double helical structure of DNA (Watson-Crick model), various forms of DNA. RNA, types of RNA, functions. Basic introduction of replication, transcription andtranslation.	8	CO1
2		Chromosome structure and morphology, chromosomal abnormalities, numerical and structural abnormalities, cytogenetic nomenclature Processing of specimens, Banding techniques, karyotyping, spectral karyotyping	8	CO2
3		Blotting Techniques, southern blot analysis, PCR, variantsof PCR, ISH, FISH Molecular Diagnosis of sickle cell anaemia, CML, AML, and Thalassaemia.	8	CO3
4	**Body Fluid, Process of nucleic acid**	Body fluids, types of body fluids, common cells in body fluids, examination of CSF, pleural, pericardial,peritoneal, synovial fluids Bone marrow collection, processing, smear preparation and staining., stem cell banking,	8	CO4
5		Purification and Separation of nucleic acids, Extraction and Purification of nucleic acids, Detection and Quantitation of Nucleic acids, Gel Electrophoresis. Nucleic Acid Hybridization: Principle and application - Preparation of nucleic probes, Principle of Nucleic acid hybridization, microarrays. Western blot, ELISA	8	CO5

Reference Books:

1. Keith Wilson & John Walker (2010): Principles and techniques of biochemistry and molecular Biology (Seventh Edition).
2. Steven L. Gersens (2013): The Principles of clinical cytogenetics (Third edition)
3. Thomas Liehr (2022): Cytogenetics and molecular Cytogenetics (First edition).

e-Learning Source:

1 https://www.youtube.com/watch?v=5hw6hBktch0
2 https://www.youtube.com/watch?v=kOCcmJ3nVQ4
3 https://www.youtube.com/watch?v=jWXHcLu-SWQ

	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.**
LS608	**Cytogenetics & Molicular Diagnosis**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	**LS609**	**Title of the Course**	**CYTOGENETICS & MOLECULAR DIAGNOSIS - LAB**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**IV**	0	0	6	**3**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	1. To develop the understanding about the concepts and applications of immunology, the immune system, and how to perform and interpret associated tests. **2.** To impart the knowledge about defenses and inflammation, human microbe relationships, bacterial virulence factors and the mechanisms involved in immunity, and tumor markers and immune response.						

Course Outcomes	
CO1	Students are able to learn about structural aspects of nucleic acid.
CO2	Students are able to learn about structure and morphology of chromosome.
CO3	Students are able to learn about different molecular techniques.
CO4	Students are able to learn about body fluid examinations.
CO5	Students are able to learn about different process of nucleic acid.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Nucleic acid, Chromosome, Molecular Techniques, Body Fluid, Process of nucleic acid**	DNA Isolation, Quantification and Purification	60 hrs	CO1 - CO5
2		To check the Quality and Integrity of DNA		
3		Molecular Techniques – Polymerase Chain Reaction, Enzyme Linked Immuno Sorbent Assay, Fluorescence In Situ Hybridization		
4		Blotting Techniques and DNA Microarrays		

Reference Books:

4. Keith Wilson & John Walker (2010): Principles and techniques of biochemistry and molecular Biology (Seventh Edition).
5. Steven L. Gersens (2013): The Principles of clinical cytogenetics (Third edition)
6. Thomas Liehr (2022): Cytogenetics and molecular Cytogenetics (First edition).

e-Learning Source:

4 https://www.youtube.com/watch?v=5hw6hBktch0

5 https://www.youtube.com/watch?v=kOCcmJ3nVQ4

6 https://www.youtube.com/watch?v=jWXHcLu-SWQ

	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
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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.**
LS609	**Cytogenetics & Molicular Diagnosis - Lab**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	**3,4**
		√	√	√	√		√	√	

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	**LS610**	**Title of the Course**	**SEMINARS**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**III**	**0**	**5**	**0**	**5**
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	This course will serve as a platform for students to integrate various instrument and technique use in pathology lab in various departments.						

Course Outcomes	
CO1	The students will understand and interpret latest advancements through different technical papers, reports, Journals, Data sheets, books etc
CO2	The students will inculcate the skills for literature survey and will learn to manage resources effectively.
CO3	The students will be able to summarize the recent research and technologies in the form of review and will be able to deliver power point presentations on an assigned topic.
CO4	The students will be able to communicate his/her ideas with his peers as audience, which will enhance both oral and written communication skills.
CO5	The students will be able to create interest to pursue lifelong learning.

SEMINAR PRESENTATION ASSESSMENTN FORM

Name of Student:		**Session:**	
Enrollment Number:		**Date:**	
Name of Subject:	Seminar	**Subject code:**	LS610
Topics:			

Criteria	Sub-Criteria	Max. Marks	Marks Obtained
Introduction (Max marks-18)	Use appropriate background information	**06**	
	Has clear statement of purpose	**06**	
	Shows a logical sequence	**06**	
Factual Content (Max marks- 42)	Includes accurate information	**06**	
	Shows up-to-date content	**06**	
	Presents relevant content	**06**	
	Shows in-depth and sufficient details	**06**	
	Addresses all important issues	**06**	
	Is selective	**06**	
	Use of proper English Grammar in the text	**06**	
Presentation Quality (Max marks-12)	Has a good design of presentation (appropriate font, type, size, color, matter per slide etc.)	**06**	
	Has a clear verbal expression and eye contact with audience	**06**	
Response to questions (Max marks-18)	Answers question(s) correctly	**06**	
	Has the ability to think on the spot	**06**	
	Shows an ability to defend content of presentation	**06**	
Time Management (Max. mark-10)	Completes the presentation within allocated time	**10**	
	Total Marks	**100**	

Note: In case of Oral Presentation, each student will be assessed in a 20 minutes time (15 min for presentation & 5 min for discussion) out of 100 marks.

Comments/Suggestions:

(Name and signature of Incharge) **(Head, Paramedical)**

	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.
LS610	**Seminars**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	**3,4**

Integral University, Lucknow

Effective from Session: 2024-25							
Course Code	**LS611**	**Title of the Course**	**DISSERTATION**	**L**	**T**	**P**	**C**
Year	**II**	**Semester**	**IV**	0	0	30	15
Pre-Requisite	**Nil**	**Co-requisite**	**Nil**				
Course Objectives	The main objective of this course is to develop independence in the research skills and to develop the research interpretation skill. To promote education and research in pathology and provide academic and professional excellence for immediate productivity in hospital, governmental, or clinical settings for an ultimate benefit of society and environment.						

Course Outcomes	
CO1	The students will be able to perform literature review, identify state of the art in that field.
CO2	The students will be able to define the problem and develop synopsis of a defined research problem
CO3	The students will be able to establish a methodology using advanced tools / techniques for solving the problem including project management and finances.
CO4	The students will be able to prepare the research report and its oral demonstrations.
CO5	The students will be gaining practical experience in project management in biotechnological industry, be able to use various techniques in contemporary research for project, perform numerical analysis and interpret the results

Name of Student:		**Session:**	
Enrollment Number:		**Date:**	
Name of Subject:	**Dissertation**	**Subject code:**	LS611
Topics:			

S. No.	Evaluation	Point to be Considered	Max. Marks	Marks Obtained
1.	**On the basics of continuous assessment (10 Marks)**	Periodic Consultation with Guide	2	
2.		Regular collection of Data with the consultation of guide.	2	
3.		Command of the topic & presentation skill	2	
4.		Methods, analysis, dissuasion and Conclusions	2	
5.		Contribution to knowledge and thesis structure	2	
Review all heading				
1.	**On the basics of External Evaluators at the time of End Sem Examination**.	Introduction	3	
2.		Aims, objectives & research hypothesis	3	
3.		Review of literature	3	
4.		Material & Methods	3	
5.		Data analysis & results	3	
6.		Discussion, lamination & future study	3	
7.		Conclusion, signification.	3	
8.		Bibliography	3	
9.		Tables, graph, diagram & Annexure (if any) Statistical Analysis Master Chart	3	
10.		The deface of study	3	
		Total Score	**40**	

Note: Evaluation of Dissertation of MMLT- Students has to prepare oral presentation; each student will be assessed in a 20 minutes time (15 min for presentation & 5 min for discussion). The evaluation of dissertation by external examiner with proper approval of concern authorities. The end semester examination will be 40 marks as external evaluations and 60 marks will be by the internal examiner (continuous assessment):

Comments/Suggestions:

(Name and signature of Incharge) **(Head, Paramedical)**

	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	3	2	3	2	3	1	2	1	-	-	3	2	3	3	2
CO2	3	3	3	3	2	2	3	2	1	3	-	-	2	2	3	2	3
CO3	3	3	3	3	2	2	3	2	1	3	-	-	3	2	2	2	3
CO4	3	3	3	3	2	2	3	2	1	3	-	-	2	3	2	2	3
CO5	3	3	3	3	2	2	3	2	1	3	-	-	3	2	3	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation Attributes & SDGs Common for all branches / Disciplines

Course Code	Course Title	Attributes							SDGs No.
LS611	**Dissertation**	Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
		√	√	√	√		√	√	**3,4,9, 17**