

STUDY & EVALUATION SCHEMES
OF
BACHELOR OF SCIENCE IN
MEDICAL LABORATORY TECHNOLOGY
(BSc.MLT)
(B.Sc. MLT- III SEMESTER)

[Applicable w.e.f. Academic Session 2020-21]



INTEGRAL UNIVERSITY, LUCKNOW
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**Syllabus approved by Board of Study, Faculty Board, Academic Council,
Executive Council of the Integral University, Lucknow**

INTEGRAL UNIVERSITY, LUCKNOW
INTEGRAL INSTITUTE OF ALLIED HEALTH SCIENCES & RESEARCH
DEPARTMENT OF PARAMEDICAL & HEALTH SCIENCES

STUDY & EVALUATION SCHEME
BACHELOR OF SCIENCE IN MEDICAL LABORATORY & TECHNOLOGY
(B.Sc. MLT)
(w.e.f. July 2020)

II-Year

III-Semester

S. N	Code	Name of the Subject	Periods			Credits	Evaluation Scheme				Subject Total
			L	T	P		C	Sessional		Exam	
						CT		TA	Total	ESE	
1.	LT201	Clinical Haematology - I	2	1	0	3	40	20	60	40	100
2.	LT202	Histopathology & Histo-techniques - I	2	1	0	3	40	20	60	40	100
3.	LT203	Medical Biochemistry -II	2	1	0	3	40	20	60	40	100
4.	LT204	Fundamentals of Microbiology - I	2	1	0	3	40	20	60	40	100
5.	LT205	Immunology & Serology - I	2	1	0	3	40	20	60	40	100
6.	ES101	Environmental Science	2	1	0	3	40	20	60	40	100
7.	LT206	Clinical Haematology - I Lab	0	0	3	2	40	20	60	40	100
8.	LT207	Histopathology & Histo-Techniques – II	0	0	3	2	40	20	60	40	100
9.	LT208	Medical Biochemistry -II Lab	0	0	3	2	40	20	60	40	100
10	LT209	Fundamentals of Microbiology & Immunology-I Lab	0	0	3	2	40	20	60	40	100
		Total	12	06	12	26	400	200	600	400	1000

L: Lecture

T: Tutorials

P: Practical

C: Credit

CT: Class Test

TA: Teacher Assessment

ESE: End Semester Examination

Sessional Total: Class Test + Teacher Assessment

Subject Total: Sessional Total + End Semester Examination (ESE)

SUBJECT: CLINICAL HAEMATOLOGY- I
SUBJECT CODE: LT201

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Learning Objective:

- The haematology curriculum aims to prepare students in basic understanding of composition of blood. Students would also be introduced to laboratory waste management protocols, instrumentation, techniques and methods of estimating different parameters of blood.
- The academic emphasis of this module is that students would learn basic hematological techniques including blood coagulation tests, blood banking and automation.

Learning Outcome:

- Students will be able to collect, preserve and process blood samples. They will be able to perform efficiently routine investigations in clinical haematology laboratory.
- Students will also be able to carry out different immune-hematological investigations and coagulation profile tests. They will be able to handle automated instruments.

Syllabus

1. Structure and metabolism of RBCs. Structure of normal haemoglobin and its metabolism. Variation of size and shape.
2. Definition of Anaemia and its classification (Morphological and etiological) pathogenesis, laboratory investigations in a case of anaemia.
3. Anemia of blood loss - acute and chronic
4. Anemia of Diminished erythropoiesis
Iron deficiency anaemia - pathogenesis, and laboratory investigations. Principle and procedure of special tests - Estimation of iron, TIBC, Transferrin, Ferritin, Plasma haemoglobin, Perls Prussian blue staining.
Macrocytic anemia - pathogenesis, and laboratory investigations of Megaloblastic anaemia, pernicious anaemia, pathogenesis, clinical features, laboratory investigations, test for Vit.B12, Folic acid, FIGLU test and Schilling test.
5. Features of Haemolytic anaemia (extravascular and intravascular hemolysis).
Hemolytic anaemia of non-immune origin
Sickle cell anemia, sickle cell trait, pathogenesis, clinical features, laboratory investigations. Principle and procedure of special test, Sickling test.
Briefly about G-6-PD deficiency disease, tests for diagnosis, Hereditary spherocytosis and test for diagnosis (Osmotic fragility test, Heinz bodies).
Immune-hemolytic anemia

Suggested Readings:

1. Mukherjee .L.K(2017), Medical Laboratory Technology, Vol.1-3, 3rd edition, Tata Mcgraw Hill
2. Sood Ramnik,(2015), Text book of Medical Laboratory Technology, 2nd edition, Jaypee Publications
3. Wintrobe's Clinical Haematology,(2014), 13th edition, Lippincott Williams & Wilkins
4. De Gruchy's Clinical Haematology in Medical Practice,(2012), Sixth edition, Wiley Publications
5. Dacie & Lewis Practical Haematology, (2011), 11th edition, Elsevier Publications.

SUBJECT: HISTOPATHOLOGY & HISTOTECHNIQUES - I
SUBJECT CODE: LT202

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Learning Objective:

1. 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.
2. The unique preposition of this paper is that the students should learn the basic histopathological techniques including laboratory organization ,histopathology techniques

Learning Outcome:

1. Students will be able to receive process and preserve the tissue samples and can efficiently perform routine investigations in clinical haematology laboratory.
2. They will be able to handle different automated instruments used for above tests.

Unit-I

- Introduction of histopathology, laboratory organization, care & maintenance of equipments used in histotechnology lab.
- Safety measures in histotechnology lab reception, recording, labeling and transportation of tissue specimens.
- Basic concepts of fixation and various types of fixative used in histopathology and cytopathology.

Unit-II

- Grossing of tissues, whole mount, sections, tissue processing and its steps, manual and automated method, components & principle of automatic tissue processor.
- Decalcification, decalcification methods, types of decalcifying fluid, Processing of bones and teeth, Embedding media, its type and properties.

Unit-III

- Microtome, its type and working, various type of microtome, Microtome knives, its type and knife sharpening, Section cutting, fault and remedies, Section adhesive.

Unit-IV

- Progressive, regressive, vital, supravital staining, types of hematoxylin, Haematoxylin and eosin staining, use of control sections in tissue staining, mounting and mounting media, advantages & disadvantages, refractive index

Suggested Readings:

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,3rd edition,Bhalani Publications
4. CFA Culling, (1974), Handbook of Histopathological and Histochemical techniques: Including Museum Techniques, 3rd edition, Butterworths publishers

SUBJECT: MEDICAL BIOCHEMISTRY - II
SUBJECT CODE: LT203

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Learning Objective: This course deals with fundamentals of metabolism, metabolic disorders, laboratory test and instruments of Clinical Biochemistry

UNIT- I

Introduction of Metabolism, Metabolism of Carbohydrates: Glycolysis, TCA cycle, Gluconeogenesis, Glycogenesis, Glycogenolysis, Hexose monophosphate Pathway. Biological Oxidation and Electron Transport Chain.

UNIT – II

Blood glucose homeostasis and its regulation, Insulin, glucagon, C- peptide.

Diabetes mellitus, types, clinical features, diabetic profile test, HbA1C, Fructosamine, GTT, Glycosuria, Hyperglycemia and Hypoglycemia.

UNIT – III

Metabolism of Proteins: Formation of ammonia, Transamination, Deamination, Urea, Cycle, Significance of Urea cycle, metabolism of Aromatic and Branched chain amino acids, Aminoaciduria.

UNIT – IV

Metabolism of Lipids: Fatty acid synthesis, Beta oxidation of fatty acids, Ketone bodies and ketosis, Cholesterol metabolism, metabolism of Lipoproteins, Lipid profile, Hyperlipidemia, Dyslipidemia and Atherosclerosis.

UNIT – V

Acid- Base balance and pH: pH and its Regulation, Metabolic and Respiratory Disorders.

Principle, application, calibration and maintenance of colorimeter, Blood Chemistry analyzer, ABG analyzer, Flame photometer, Turbidimetry, Nephelometry.

Learning Outcome: At the end of the course students should be able to understand the fundamentals of metabolism application of the analytical instrument used in the routine clinical laboratory & can perform and interpret the various parameters.

Recommended Books:

1. D M Vasudevan, Text book of Medical Biochemistry, Jaypee Publishers
2. M N Chatterjea & Rana Shinde, Text book of Medical Biochemistry, Jaypee Publications
3. Michael Cox, David L. Nelson, Lehninger Principles of Biochemistry, 7th edition, W. H. Freeman
4. Ranjna Chawla, Practical Clinical Biochemistry: Methods and Interpretations

SUBJECT: FUNDAMENTAL OF MICROBIOLOGY - I

SUBJECT CODE: LT204

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Learning Objective: This subject gives a general insight into the history, basics of microbiology and imparts knowledge about equipment used in microbiology.

Unit-I

- Development of microbiology as a discipline, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Edward Jenner
- Introduction to bacterial taxonomy, Classification of Bacteria, Morphology based on size, shape, arrangement, motility, flagella, spores, capsules, cell wall, plasma membrane, pili, ribosomes.

Unit-II

- Microscopy: Study of compound microscope – magnification, numerical aperture, resolution and components of microscope.
- Dark ground illumination, care of microscope and common difficulties micrometry
- Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Transmission Electron Microscope, Scanning Electron Microscope

Unit-III

- Cell size, shape and arrangement, cell-wall, composition and detailed structure of Gram-positive and Gram-negative cell walls, Cell Membrane
- Structure, function and chemical composition of bacterial cell membranes
- Cytoplasm: Ribosome, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids, Endospore: Structure, formation

Unit-IV

- General safety measures used in Microbiology laboratory,
- Sterilization and disinfection: Various physical methods of sterilization heat,
- UV radiation, ionizing radiation, filtration, characters affecting sterilization, autoclave control and sterilization indicators.
- Biomedical waste management in a Medical Microbiology laboratory: Types of the waste generated, Segregation, Treatment, Disposal

Unit-V

- Antiseptics & Disinfectants: Definition, types and properties, mode of action, use, qualities of good disinfectants
- Chemical disinfectants – phenol and its compounds, alcohol, halogen, heavy metals and quaternary ammonium compounds, aldehyde, gaseous compound use and abuse of disinfectants. precautions while using the disinfectants

Learning Outcome: This course make the students to know handling of instruments and sterilization techniques.

Suggested Readings:

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013)
3. Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
5. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
6. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.

SUBJECT: IMMUNOLOGY & SEROLOGY - I
SUBJECT CODE: LT205

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2 1 0

Learning Objective: 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.

Unit-I

- Historical background, general concepts of the immune system, innate and adaptive immunity; active and passive immunity; primary and secondary immune response
- Cell and organs of immune system, Phagocytosis

Unit-II

- Antigens and haptens : Properties, foreignness, molecular size, heterogeneity, B and T cell epitopes; T dependent and T independent antigens
- Antibodies: Historical perspective of antibody structure; structure, function and properties of the antibodies; different classes, subclasses and biological activities of antibodies; concepts of antibody diversity, isotype, allotype
- Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody

Unit-III

- Mechanism of humoral and cell mediated immune response
- Introduction of Major Histocompatibility Complex, organization of MHC and inheritance in humans; Antigen presenting cells, antigen processing and presentation
- Complement system and complement fixation test

Unit-IV

- Laboratory tests for demonstration of antigen antibody reaction such as agglutination, precipitation, ELISA, RIA, Immunofluorescence

Unit-V

- Rheumatological diseases, etiology and pathogenesis and lab investigations

Learning Outcome: The students will learn scientific approaches/techniques that are used to investigate various diseases.

Suggested Readings:

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology. 11th edition Wiley- Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
5. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
6. Richard C and Geiffrey S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.

SUBJECT: ENVIRONMENTAL SCIENCE

SUBJECT CODE: ES101

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2 1 0

Learning Objective: The student will be made aware of our environment in general, natural resources, ecosystems, environmental pollution and social issues related to environment.

UNIT-I

Natural resources: Renewable and non-renewable resources: Natural resources and associated problems.

- a) **Water Resources:** Use and over utilization of surface and ground water, **floods**, drought, conflicts over water, dams- benefits and problems.
- b) **Mineral Resources:** Use and exploitation, environmental effects of extracting and using minerals resources, case studies.
- c) **Food Resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer -pesticide problems, Water logging, Salinity, case studies.
- d) **Energy Resources:** Growing energy needs, renewable and nonrenewable energysources, use of alternate energy sources, case studies.
- e) **Land Resources:** Land as a resource, Land degradation, Man induced landslides, Soil erosion and desertification.
 - Role of an individual in conservation of natural resources
 - Equitable use of resources for sustainable life styles.

UNIT-II

Ecosystems:

- a) Concept of an Ecosystem.
- b) Structure and Function of an Ecosystem.
- c) Producer Consumer and decomposers.
- d) Energy flow in the Ecosystem.
- e) Ecological Succession.

UNIT-III

Biodiversity and its conservation:

- a) Introduction - Definition: Genetic, Species and Ecosystem diversity.
- b) Bio-Geographical classification of India,
- c) Value of Bio-diversity: Consumptive use, productive use, Social, ethical, aesthetic and option values
- d) Biodiversity at Global, National & Local levels.
- e) Hotspots of Biodiversity
- f) Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts

UNIT-IV

Environmental Pollution:

- a) Definition, Causes, effects and control measures of-Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Hazards
- b) Solid Waste Management: Causes, effects and control measures of urban and Industrial Wastes.
- c) Role of an Individual in prevention of pollution.
- d) Pollution case studies
- e) Disaster Management: floods, earthquake, cyclones and landslides.

UNIT-V

Social Issues and the Environment:

- a) Resettlement and Rehabilitation of people; its problems and concerns, case studies.
- b) Environmental ethics: issues and possible solutions
- c) Green house effect and global Warming, effects of acid Rain and their remedial measures and ozone Layer depletion.

Human Population and the Environment

- a) Population growth variation among nations, Population Explosion, Family welfare programme,
- b) Environment and Human Health,
- c) Human Rights.
- d) HIV/AIDS, Women and Child welfare
- e) Role of Information Technology in Environment and Human Health, Case studies.

Learning Outcome: Students will understand / evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn help in sustainable development.

BOOKS RECOMMENDED

1. Agarwal, K.C. 2001 Environmental; Biology, Nidi Pub. Ltd.Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mappin Pub. Pvt. Ltd., Ahemdabad-380, India.
3. Brunner R.C. 1989. Hazardous waste incineration, Mc Graw Hill.
4. Clark R.S. Marine Pollution, Clanderon Press Oxford (TB).
5. Cunningham W.P.2001.Cooper, T.H. Gorhani, E&Hepworth, Environmental encyclopedia, Jaicob Publication House, Mumbai.
6. De . A.K. Environmental chemistry Willey Eastern Limited.

SUBJECT: CLINICAL HAEMATOLOGY- I LAB

SUBJECT CODE: LT206

(w.e.f. Session-2020)

1. Determination of haemoglobin by various methods.
2. Determination of Total RBC count.
3. Determination of PCV
4. Determination of red cell indices
5. Demonstration of hypochromic microcytic slide.
6. General blood picture
7. Determination of G-6-PD
8. Differential Leucocyte Count.
9. Absolute leucocyte count
10. Demonstration of toxic granulation of neutrophil
11. To perform PT and Calculate INR
12. To perform APTT
13. To perform sickling test
14. Determination of Plasma Hemoglobin
15. To perform reticulocyte count.

SUBJECT: HISTOPATHOLOGY & HISTOTECHNIQUES- II LAB

SUBJECT CODE: LT207

(w.e.f. Session-2020)

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1. Demonstration of glass wares and equipment used in histopathology lab.
2. To prepare alcohol of different concentration.
3. To prepare formalin from stock solution.
4. To sharp knife by honing and stropping.
5. Grossing of tissue
6. To perform tissue processing by manual method.
7. To perform section cutting of paraffin embedded tissue.
8. To fix the smear on glass slide.
9. To perform hematoxylin and eosin staining.
10. Mounting and preservation of slide.

SUBJECT: MEDICAL BIOCHEMISTRY- II LAB

SUBJECT CODE: LT208

(w.e.f. Session-2020)

1. Estimation of Serum Creatinine by Alkaline Picrate method.
2. To perform urine sugar by Benedict's/ Uristix method.
3. To perform urine Ketone body analysis by Rothera Nitroprusside test.
4. Estimation of Serum Amylase.
5. Estimation of Serum Lipase.
6. Estimation of Serum Total Bilirubin by Malloy – Evelyn method.
7. Estimation of Serum Albumin by BCG method and calculation of Globulin & A/G ratio.
8. Estimation of Serum uric acid by Uricase/ PAP method.
9. Demonstration of Semi Autoanalyzer.
10. Demonstration of Flame Photometer.

Suggested Readings:

1. Ranjna Chawla, Practical Clinical Biochemistry: Methods and Interpretations
2. Praful B. Godkar, Darshan P. Godkar, Textbook of Medical Laboratory Technology
3. Dr Ramnik Sood, Medical Laboratory Technology: Methods and Interpretations
4. Bishop, Fody and Schoeff, Clinical Chemistry, techniques, principles and correlations.
5. Singh & Sahni, Introductory Practical Biochemistry

SUBJECT: FUNDAMENTALS OF MICROBIOLOGY- I LAB

SUBJECT CODE: LT209

(w.e.f. Session-2020)

1. Demonstration of Microscope and its parts
2. Demonstration of glassware used in microbiology.
3. Demonstration of autoclave and sterilization of glass wares.
4. Demonstration of Hot air oven and sterilization of glass wares.
5. To perform Gram staining
6. To perform Acid fast staining (Zeihl Neelsen staining)
7. To perform Indian ink staining
8. To perform Hanging drop method
9. Demonstration of capsule
10. Staining of bacterial spores
11. To demonstrate agglutination reaction.
12. To perform RA test
13. To perform WIDAL test
14. To perform RPR test.
15. To perform CRP test.