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

(B.Sc. MLT- IV 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. Session 2020-21)

II-Year **IV-Semester**

S. No.	Code	Name of the Subject	Periods			Credits	Evaluation Scheme				Subject Total
							Sessional			Exam	
			L	T	P	C	CT	TA	Total	ESE	
1.	LT210	Clinical Haematology-II	2	1	0	3	40	20	60	40	100
2.	LT211	Histopathology & Histotechniques-II	2	1	0	3	40	20	60	40	100
3.	LT212	Clinical Biochemistry	2	1	0	3	40	20	60	40	100
4.	LT213	Systemic Bacteriology	2	1	0	3	40	20	60	40	100
5.	LT214	Principles of Laboratory Management	2	1	0	3	40	20	60	40	100
6.	LT215	Clinical Hematology-II Lab	0	0	2	1	40	20	60	40	100
7.	LT216	Histopathology & Histotechniques-II Lab	0	0	2	1	40	20	60	40	100
8.	LT217	Clinical Biochemistry - Lab	0	0	2	1	40	20	60	40	100
9.	LT218	Hospital Posting	0	0	14	7	40	20	60	40	100
		Total	**10**	**05**	**20**	**25**	**360**	**180**	**540**	**360**	**900**

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 - II
SUBJECT CODE: LT210
(w.e.f. Session-2020)

L T P
2 1 0

LEARNING OBJECTIVE:

- The haematology curriculum aims to prepare students in basic understanding of Hematological disorders and their laboratory diagnosis and basics of blood banking. Students would also be introduced to laboratory instrumentation, techniques and methods of estimating different parameters of blood and their clinical significance.
- The academic emphasis of this module is that students would learn basic, special and advanced hematological techniques and basics of blood banking.

LEARNING OUTCOME:

- Students will be able to perform efficiently routine and special investigations in Hematology lab and blood bank.

UNIT- I:

Anemia of chronic disorders, Sideroblastic anaemia, Aplastic anemia, Thalassaemia - classification, etiopathogenesis, clinical features and laboratory investigations, Hemoglobin electrophoresis. Bone marrow examination (Bone marrow needle, aspiration technique, processing and staining).

UNIT-II:

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. Blood collection, anticoagulants and additive systems.

UNIT-III:

Leukemia, Cytochemistry - Detail of cytochemical stains, its preparation, Role of cytochemistry in diagnosis of various types of leukemia.

UNIT-IV:

Disorders of platelets - Qualitative and quantitative. Disorders of primary and secondary hemostasis, approach to patient with bleeding and coagulation disorders. Hemophilia and Von-Willebrand disease and their lab diagnosis, Disseminated intravascular coagulation, Disorder of fibrinogen, quantitative factor assay.

UNIT- V:

LE cell, its demonstration, procedure of LE cell test and its clinical significance, Demonstration of Blood parasites - Malaria, Filariasis, Leishmania.

LEARNING OUTCOME:

This course made the students competent enough to perform various laboratory test related to acute and chronic hematological disorders.

RECOMMENDED BOOKS:

1. Godkar B' Praful (2016): Textbook of Medical laboratory Technology (3rd edition) Bhalani Publications
2. Singh Tejinder (2014): Atlas & Textbook of Haematology (3rd edition), Avichal Publications.
3. Sood Ramnik (2015): Medical Laboratory Technology: Methods and Interpretations (vol - 1 & 2).
4. Lewis, Mitchell S: Dacie and Lewis Practical Hematology.
5. Kawthalkar, Shrish M: Essential of Clinical Pathology.
6. R N Makroo, (2009), Compendium of Transfusion medicine,2nd edition, Career Publications.
7. SR Mehdi, Essential of Blood Banking; 2nd Edition, Jaypee publicatons

SUBJECT: HISTOPATHOLOGY & HISTOTECHNIQUES- II
SUBJECT CODE: LT211
(w.e.f. Session-2020)

L	T	P
2	1	0

LEARNING OBJECTIVE:

1. The curriculum of histopathology and its techniques aims to prepare the students to understand and learn about handling and processing of biopsies and procedure of special staining techniques.
2. Students would learn the basic histopathological (routine and special).

UNIT-I:

A. Staining of carbohydrates:

1. **PAS STAIN -** preparation of periodic acid and Schiff reagent, procedure of staining, and control section clinical usefulness of PAS stain.
2. **ALCIAN BLUE STAIN -** Preparation, staining and procedure.
3. Other staining method of carbohydrates.

B. Connective tissue & its staining: Preparation and procedure of Trichrome staining, Verhöeff stain, Gordon and Sweet's stain, Gomori's method, van Gieson stain, PTAH stain

UNIT-II:

Demonstration of AFB, Demonstration of minerals and pigments in tissue sample, Actinomyces, fungi.

UNIT-III:

Demonstration of nucleic acid, processing and staining of bone marrow sample. Fixation, Processing and section cutting of bones, Techniques in neuro pathology: Specimen handling in Neuropathology lab, Staining of Neurons, Myelin and eyeball.

UNIT-IV:

Museum techniques - composition and preparation of keiserling fluid.

Electron microscopy: Principle, procedure of fixation, processing and staining of tissue.

Fluorescence Microscope: Principle and role in histopathology.

UNIT- V:

Immunohistochemistry: principle, types, applications, antigen retrieval, APAAP, PAP Staining method. Quality control in histopathology.

LEARNING OUTCOME:

1. Students will be able to receive process and preserve tissue samples (routine and special).
2. They will be able to handle different automated instruments used for above tests.

RECOMMENDED BOOKS:

1. Bancroft's Theory and Practice of Histological Techniques,7th Edition, ElsevierPublications.
2. Harshmohan (2017), Textbook of Pathology, 7thedition, Jaypee Publications.
3. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition, Bhalani Publications.
4. CFACulling,(1974), Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques, 3rd edition, Butterworths Publishers

SUBJECT: CLINICAL BIOCHEMISTRY
SUBJECT CODE: LT212
(w.e.f. Session-2020)

L	T	P
2	1	0

LEARNING OBJECTIVE:

This paper gives brief understanding about various types of function test, acid base balance and associated disorders.

UNIT-I:

Liver function tests: Introduction, bile pigment metabolism, jaundice and its types, Estimation of Bilirubin, Bile salt, Bile pigments, urobilinogen, SGPT/ALT, SGOT/AST, ALP, GGT, Viral Hepatitis

UNIT-II:

Renal Function Test: Introduction, Glomerular filtrationrate, renalthres hold, Urea, Creatinine, Uric Acid, Sodium, Potassium, Creatinine Clearance test, Urea clearance test, examination of renal calculi.

UNIT-III:

Cardiac Function test: Introduction, myocardial infarction, CHD, Biochemical markers of Heart diseases, Role of laboratory in monitoring heart diseases.

UNIT-IV:

Gastric function Test: Introduction, gastric secretions, total and free acid, stimulation test, physical & chemical examination of gastric secretions.

Tumor markers: Introduction, types, applications

UNIT-V:

Acid base balance, action of buffer system, Hb buffers, respiratory and metabolic acidosis, respiratory and metabolic alkalosis, arterial blood gas analysis, blood gas analyzer.

LEARNING OUTCOME:

Students will know basics and procedure of different parameters used to assess organ function**.**

RECOMMENDED BOOKS:

1. DMVasudevan,(2011),TextbookofMedicalBiochemistry,6th editionJaypeePublishers
2. MNChatterjea&RanaShinde,(2012),TextbookofMedicalBiochemistry,8th ed ition,Jayppe Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alphascience
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W HFreeman
5. U Satyanarayan,(2008), Essentials of Biochemistry,2nd edition, Standard Publishers
6. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,ElsevierPublications

SUBJECT: SYSTEMIC BACTERIOLOGY
SUBJECT CODE: LT213
(w.e.f. Session-2020)

L	T	P
2	1	0

LEARNING OBJECTIVE:

This paper gives brief understanding about various types of Bacteria, and associated disorders.

UNIT-I:

1. Staphylococcus
2. Streptococcus, Enterococccus and Pneumococcus
3. Neisseira & Moraxella

UNIT-II:

1. Corynebacterium
2. Bacillus
3. Clostridium

UNIT-III:

1. Enterobacteriaceae
2. Mycobacteria.
3. Vibrio

UNIT-IV:

1. Pseudomonas
2. Haemophilus
3. Spirochaetes

UNIT-V:

Miscellaneous Bacteria, with reference to their-

1. Morphology,
2. Cultural Characteristics,
3. Biomedical reactions,
4. Pathogenesis/ Disease caused & lab diagnosis

LEARNING OUTCOME:

Students will know basics and procedure of different parameters used to assess Characteristics of different kinds of bacteria.

RECOMMENDED BOOKS:

1. DMVasudevan,(2011),TextbookofMedicalBiochemistry,6th editionJaypeePublishers
2. MNChatterjea&RanaShinde,(2012),TextbookofMedicalBiochemistry,8th edition,Jayppe Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alphascience
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W HFreeman
5. U Satyanarayan,(2008), Essentials of Biochemistry,2nd edition, Standard Publishers

SUBJECT: PRINCIPLES OF LABORATORY MANAGEMENT
SUBJECT CODE: LT214
(w.e.f. Session-2020)

L	T	P
2	1	0

LEARNING OUTCOME:

The students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab.

UNIT-I:

Ethical Principles and standards for a clinical laboratory professional duty to the patient, duty to colleagues and other professionals, Good Laboratory Practice (GLP), Introduction to Basics of GLP and Accreditation, Aims of GLP and Accreditation, Advantages of Accreditation, Brief knowledge about National and International Agencies for clinical laboratory accreditation

UNIT-II:

Awareness / Safety in a clinical laboratory, General safety precautions.

HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines, Drug Resistant Tuberculosis

Patient management for clinical samples collection, transportation and preservation, Sample accountability, Purpose of accountability, Methods of accountability

UNIT-III:

Sample analysis: Introduction, factors affecting sample analysis, reporting results, basic format of a test report, reported reference range, clinical alerts, abnormal results, results from referral laboratories, release of examination results, alteration in reports

UNIT-IV:

Quality Management system: Introduction, Quality assurance, Quality control system, Internal and External quality control, quality control chart Biomedical Introduction and importance of calibration and Validation of Clinical Laboratory instrument Ethics in Medical laboratory Practice, Ethics in relation to Pre-Examination procedures, Examination procedures, reporting of results, preserving medical records Procurement of equipment and Inventory Control,

UNIT-V:

Audit in a Medical Laboratory, Introduction and Importance, NABL & CAP, Responsibility, Planning, Horizontal, Vertical and Test audit, Frequency of audit, Documentation

LEARNING OUTCOME:

Students would be competent enough to understand sample accountability, quality management system, biomedical waste management, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.

RECOMMENDED BOOKS:

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

SUBJECT: CLINICAL HAEMATOLOGY- II
LAB SUBJECT CODE: LT215
(w.e.f. Session-2020)

L	T	P
0	0	2

1. Platelet count - manual and automated,
2. General blood Picture and its clinical significance,
3. Staining of bone marrow (routine romanowsky staining and pearl Prussian blue staining),
4. Demonstration of leukemic slides,
5. LAP scoring - procedure and clinical significance,
6. To determine total platelet count,
7. Procedure of thrombin time,
8. Procedure of D-dimer test and its clinical significance,
9. Fibrinogen assay,
10. Demonstration of hemoparasite - malaria and filaria,
11. Hemoglobin electrophoresis.

RECOMMENDED BOOKS:

1. Godkar B' Praful (2016): Textbook of Medical laboratory Technology (3rd edition) Bhalani Publications
2. Singh Tejinder (2014): Atlas & Textbook of Haematology (3rd edition), Avichal Publications.
3. Sood Ramnik (2015): Medical Laboratory Technology: Methods and Interpretations (vol - 1 & 2).
4. Lewis, Mitchell S: Dacie and Lewis Practical Hematology.
5. Kawthalkar, Shrish M: Essential of Clinical Pathology.
6. R N Makroo, (2009), Compendium of Transfusion medicine,2nd edition, Career Publications.
7. SR Mehdi, Essential of Blood Banking; 2nd Edition, Jaypee publicatons

SUBJECT: HISTOPATHOLOGY & HISTOTECHNIQUES - II LAB
SUBJECT CODE - LT216
(w.e.f. Session-2020)

L	T	P
0	0	2

1. Grossing of tissue, tissue processing by manual method,
2. Section cutting of paraffin embedded tissue,
3. To fix the smear on glass slide, hematoxylin and eosin staining,
4. PAS staining,
5. AFB staining.

RECOMMENDED BOOKS:

1. Bancroft's Theory and Practice of Histological Techniques, 7th Edition, ElsevierPublications.
2. Harshmohan (2017), Textbook of Pathology, 7thedition, Jaypee Publications.
3. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition, Bhalani Publications.
4. CFACulling,(1974), Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques, 3rd edition, Butterworths Publishers

SUBJECT: CLINICAL BIOCHEMISTRY- LAB
SUBJECT CODE - LT217
(w.e.f. Session-2020)

L	T	P
0	0	2

COURSE CONTENT: Clinical Biochemistry-Practical

1. To determine total, direct and indirect bilirubin.
2. To determine SGOT conc.
3. To determine SGPT conc.
4. To determine ALP Conc.
5. To determine total and free acidity.
6. To perform CPK test
7. To perform CK-MB test.
8. To determine serum sodium conc.
9. To determine serum potassium conc.
10. To determine uric acid conc.
11. To determine phosphorus conc.

LEARNING OUTCOME:

Students will know basics and procedure of different parameters used to assess organ function**.**

RECOMMENDED BOOKS:

1. DMVasudevan,(2011),TextbookofMedicalBiochemistry,6th editionJaypeePublishers
2. MNChatterjea&RanaShinde,(2012),TextbookofMedicalBiochemistry,8th ed ition,Jayppe Publications
3. Singh & Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alphascience
4. Lehninger,(2013),Principles of Biochemistry,6th edition, W HFreeman
5. U Satyanarayan,(2008), Essentials of Biochemistry,2nd edition, Standard Publishers
6. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,ElsevierPublications

SUBJECT: HOSPITAL POSTING
SUBJECT CODE: LT218
(w.e.f. Session-2020)

L T P

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COURSE CONTENT:

Students shall be deputed to various labs of Pathology department wherein they shall undergo practical training of handling patients, collection and processing of blood, urine, sputum stool and body fluids samples. Identification of patient's particulars based on CR number, Lab Number and transfer of samples from collection centres to different labs. Process of performing various tests in different labs. Each student is required to maintain a logbook of the various posting. Student's performance shall be evaluated on continuous basis by the faculty posted in various sections. The faculty shall submit the assessment records of each student posted in his/her section on monthly basis to the HOD. Marks will be awarded out of 100.