REGULATIONS AND SYLLABUS
FOR
ADVANCED DIPLOMA IN CLINICAL LABORATORY SCIENCE

Offered by

BHARATHIAR UNIVERSITY, COIMBATORE
FROM 2007-2008

Under The

UNIVERSITY INDUSTRY INTERACTION AND
CONSULTANCY SERVICE CENTER (UIICSC)
COLLABORATIVE PROGRAMME

ADVANCED DIPLOMA IN CLINICAL LABORATORY SCIENCE

1. Description of course / objective of the course

This course is designed to prepare technicians with specialized skills, knowledge and attitude to work in a clinical laboratory.
The program will be conducted at a hospital recognized by Bharathiar University under the UIICSC collaboration program. Candidate shall abide by the stipulated timings, discipline, rules and regulations of the hospital to which they will be assigned for the entire course.

2. Regulations

a. Pass in +2 examination
b. B. Sc graduates can also apply.

3. Duration of the course

The course shall extend over a period of 18 months inclusive of admission, examination and co-curricular activities, excluding sundays and festival holidays declared by the Government of Tamilnadu. Examination shall be conducted at the end of 12 months and 18 months.

4. Course and scheme of examination

I Year

Paper No.	Subject	University examination		Credits
		Internal	External	
1.	Anatomy, physiology, basic laboratory principles	40	60	4
2.	Biochemistry	40	60	4
3.	Microbiology	40	60	4
4.	Hematology / Clinical pathology / Blood banking	40	60	4
5.	Practical: Biochemistry I	40	60	4
6.	Practical: Microbiology I	40	60	4
7.	Practical: Haematology / Clinical pathology / Blood banking I	40	60	4

II Year

Paper No.	Subject	University examination		Credits
		Internal	External	
1.	Histopathology, cytology	40	60	4
2.	Biochemistry, Microbiology & Haematology	40	60	4
3.	Practical: Biochemistry II	40	60	4

4.	Practical: Microbiology II	40	60	4
5.	Practical: Haematology / Clinical pathology / Blood Banking - II	40	60	4
6.	Practical: Histopathology and cytology	40	60	4
7.	Internship/ Project work- Viva Voice	80	120	8

5. Practical training

Being a practical oriented program, the focus will be more on practical training. The candidate shall undergo practical training in doing the laboratory tests of various kinds in the laboratories or hospitals of Bharathiar University affiliated institutions.

6. Requirement to appear for examination

Candidate should put in a minimum of 90 % attendance to appear for the examinations.

7. Passing minimum

To pass

- A candidate shall secure a minimum of 50 % in the practical and theory to pass the examination. A candidate failing in any one of the component will have to reappear for that particular component only in the supplementary examinations.

- A candidate shall secure 50 % marks in the internals.

8. Classification of successful candidate

- A candidate securing 75 % and above, aggregate in theory and practical examinations, in the first attempt shall be deemed to have passed the examination with distinction.

- A candidate securing 60 % to 74 % of the aggregate in theory and practical examinations, in the first attempt shall be deemed to have passed the examination in the first class.
- Other Successful candidates shall be declared to have passed the examination in Second Class.

9. Conferment of degree

A candidate who has passed all the examinations as prescribed shall be eligible to receive the **"ADVANCED DIPLOMA IN CLINICAL LABORATORY SCIENCE"** from the Bharathiar University.

10. Ranking

Candidates who have passed all the examinations in the very first attempt and securing the first position in aggregate marks for every 10 candidates appearing in the

examinations, ranking (with the maximum of 10 positions) will be awarded university ranks.

11. Revision of regulation and syllabus

The syllabus and regulations of the course are subject to modification by the concerned board whenever necessary.

12. Question paper pattern

Theory examination will be for 100 marks with the following components which will be converted into 60 marks.

- Multiple choice / one word answers : 20 x 1 = 20 marks (no choice)
- Short notes (100 words/ one paragraph) : 5x6 = 30 marks (either/or type)
- Elaborate (300 words or 1½ paper) : 5x10 = 50 marks (either/or type)

I YEAR: PAPER 1
ANATOMY, PHYSIOLOGY, BASIC LABORATORY PRINCIPLES

UNIT I
Introduction
Phlebotomy and sample collection
Basic Chemistry
Cell Biology
Laboratory equipments
Laboratory safety
Ethics

UNIT II - Anatomy of human body
Gastrointestinal
Hepatobiliary
Cardiovascular
Respiratory

UNIT III - Anatomy of human body
Excretory
Reproductive
Musculoskeletal
Central nervous system
Endocrine

UNIT IV - Physiology of human body
Gastrointestinal
Hepatobiliary
Cardiovascular
Respiratory

UNIT V - Physiology of human body
Excretory
Reproductive
Musculoskeletal
Central nervous system
Endocrine

References :

1. Grays Anatomy – Churchill, Livingstone
2. TS Ranganathan – Text book of human anatomy
3. Chatterjee – Human physiology
4. Ganong – Review of Medical physiology

I YEAR: PAPER 2
BIOCHEMISTRY

UNIT I

Carbohydrate – absorption, metabolism,
Maintenance of blood glucose levels – hormonal influence,
Diabetes mellitus
Tests involved in carbohydrate metabolism.

UNIT II

Protein – digestion, absorption and metabolism – urea synthesis,
Tests involved in protein metabolism.
Lipid digestion, absorption and metabolism
Tests involved in lipid metabolism

UNIT III

Renal function tests
Liver function tests
Arterial blood gas analysis

UNIT IV

Water, electrolyte and buffer systems – sodium, potassium, chloride, bicarbonate, metabolism and estimation
Minerals – calcium, phosphorous, iron, magnesium, copper – metabolism and estimation
Vitamins and enzymes

UNIT V

Biologically important hormones : insulin, glucagons, epinephrine, thyroid, growth hormone, parathyroid, pituitary, steroid hormones

References :

1. Clinical Diagnosis by laboratory methods – Todd and Sanford
2. Text book of medical laboratory technology – Praful Godhar
3. Clinical biochemistry – Teitz
4. Practical clinical biochemistry – Harold Varley
5. Harpers illustrated biochemistry – Murray, Granner, Mayes, Rodwell

I YEAR: PAPER 3
MICROBIOLOGY

UNIT I

Collection and processing of samples – Urine, blood, sputum, CSF, throat swab, faeces, body fluids
Sterilization
Equipment and glass ware used in microbiology
Microscopes – Types and uses
Stains and reagents used in microbiology

UNIT II

Laboratory study of bacteria – isolation and identification – hanging drop, simple stains and special stains
Study of pathogens – morphology, isolation and identification

UNIT III

Media for cultivation of bacteria
Methods used in cultivation, isolation and identification of bacteria.

UNIT IV

Applied microbiology
Normal flora
Bacterial infections
Antibiotics susceptibility testing

UNIT V

Common pathogenic fungi of skin and subcutaneous tissue – collection of samples and lab diagnosis – stains, cultures and identifications
Basic virology : Common viral diseases – transmission – collection and despatch of specimens

References :

1. Text book of microbiology – Ananthanarayanan and Jeyaram Panicker
2. Bailey and Scott's – Diagnostics microbiology – Finegole and Barbara
3. Parasitology – K. D. Chatterjee

I YEAR: PAPER 4
HAEMATOLOGY / CLINICAL PATHOLOGY / BLOOD BANKING

UNIT I – Haematology
Automation in haematology – quality control
Haemoglobin – normal and abnormal, different types of haemoglobin
Red cells – normal and abnormal morphology, anemia – classifications and laboratory diagnosis, RBC count.

UNIT II – Haematology
Recognition and reporting of blood pictures – normal and abnormal including blood parasites
Staining of blood smears – Leishman's.
Supravital staining and reticulocyte count, iron stain, peroxidase stain, bone marrow smear staining,
PCV, red cell indices, osmotic fragility, sickle cell preparation.

UNIT III – Haematology
WBC's – normal and abnormal, – benign and malignant disorders, WBC count – total and differential counts
ESR, absolute eosinophil count, LEcell preparation,
Preparation and examination of thin, thick and wet films.

UNIT IV – Clinical pathology
Urine – Composition, collection and preservation, changes in composition of urine in relation to various diseases
Complete urine analysis – physical, chemical – glucose, protein, reducing substances, ketone bodies, blood pigments, bile. Sediments

UNIT V – Clinical pathology
Body fluids, CSF and semen analysis
Parasitology – Classification and identification of common human parasites.
Stool analysis

References :

1. Clinical Diagnosis by laboratory methods – Todd and Sanford
2. Practical haematology – Dacie and Lewis
3. Clinical biochemistry – Teitz
4. Practical clinical biochemistry – Harold Varley
5. Harpers illustrated biochemistry – Murray, Granner, Mayes, Rodwell

II YEAR: PAPER 1
HISTOPATHOLOGY AND CYTOLOGY

UNIT I
Introduction to histopathological techniques
Sample reception and record keeping
Specimen fixation and fixatives

UNIT II
Processing of tissue
Embedding

UNIT III
Microtomy
Frozen section

UNIT IV
Mounting and staining
Theory of H & E stain and special stains
Stains – AFB, Fite, PAS, PASM, Masson's trichrome

UNIT V – Cytology
Smear preparation of FNAC
Fixation of smears
Pap staining
Fluid cytology

References :

1. Culling – Histopathology techniques

II YEAR: PAPER 2
BIOCHEMISTRY, MICROBIOLOGY & HAEMATOLOGY

UNIT I – Biochemistry
Special tests – Electrophoresis, Elisa
Automation and quality control in the laboratory

UNIT II – Microbiology
Serology – Separation of sera, preservation and transport of samples for serological tests
Basic serological reactions and techniques – Agglutination, precipitation and complement fixation
Separation of sera, preservation and transport of samples for serological tests
Advanced serological techniques – Elisa

UNIT III – Haematology
Principles of blood coagulation
Disorders of coagulation and haemostasis
Platelets and disorders of platelets
Platelet count

UNIT IV – Haematology
Laboratory diagnosis of bleeding and clotting disorders with quality control
Practical aspects of one stage prothrombin time, PTT.
Clotting time, clot retraction and clot lysis, tourniquet test.
Demonstration – Haemoglobin electrophoresis, acid haemolysis test, Kleihauer preparation.

UNIT V – Blood banking
Principles of blood groups and antigen antibody reactions
ABO – Rh blood group systems, other red cell antigens and antibodies.
Coombs test – investigation of transfusion reaction and haemolytic disease of the new born, antibody detection and titration.

References :

1. Clinical Diagnosis by laboratory methods – Todd and Sanford
2. Practical haematology – Dacie and Lewis
3. Clinical biochemistry – Teitz
4. Practical clinical biochemistry – Harold Varley
5. Harpers illustrated biochemistry – Murray, Granner, Mayes, Rodwell
6. Text book of medical laboratory technology – Praful Godhkar
7. Text book of microbiology – Ananthanarayanan and Jeyaram Panicker
8. Bailey and Scott's – Diagnostics microbiology – Finegole and Barbara

PRACTICALS

I YEAR: PAPER 5 & II YEAR: PAPER 3
PRACTICAL: BIOCHEMISTRY – I & 2

UNIT I

Estimation of blood glucose
Estimation of urea
Estimation of creatinine
Estimation of HbA_1C

UNIT II

Estimation of cholesterol
Estimation of HDL, LDL, VLDL
Estimation of uric acid

UNIT III

Estimation of total protein, albumin, globulin
Estimation of bilirubin – Direct, indirect
Estimation of SGOT, SGPT, Alkaline Phosphatase

UNIT IV

Estimation of Sodium, potassium
Estimation of Chloride, Bicarbonate
Estimation of LDH

UNIT V

Estimation of Calcium, phosphorous
Estimation of ferritin, magnesium

References :

1. Clinical Diagnosis by laboratory methods – Todd and Sanford
2. Text book of medical laboratory technology – Praful Godhar
3. Clinical biochemistry – Teitz
4. Practical clinical biochemistry – Harold Varley
5. Harpers illustrated biochemistry – Murray, Granner, Mayes, Rodwell

I YEAR: PAPER 6 & II YEAR: PAPER 4
PRACTICAL: MICROBIOLOGY – I & II

UNIT I

Collection and processing of samples – Urine, blood, sputum, CSF, throat swab, faeces, body fluids
Sterilization
Equipment and glass ware used in microbiology
Microscopes – Types and uses

UNIT II

Preparation of stains and reagents used in microbiology
Preparation of different types of media

UNIT III

Isolation and identification of bacteria – normal flora and pathogens
Hanging drop, simple stains and special stains

UNIT IV

Antibiotic susceptibility testing

UNIT V

Identification of common pathogenic fungi – sample collection and special stains, culture and identification

References :

Text book of microbiology – Ananthanarayanan and Jeyaram Panicker
Bailey and Scott's – Diagnostics microbiology – Finegole and Barbara
Parasitology – K. D. Chatterjee

I YEAR: PAPER 7
PRACTICAL: HAEMATOLOGY / CLINICAL PATHOLOGY / BLOOD BANKING – I

UNIT I – Haematology
Estimation of haemoglobin
RBC count
Peripheral smear – preparation, staining, reporting
Identification of haemoparasites

UNIT II – Haematology
Reticulocyte count
Red cell indices
PCV
ESR
Osmotic fertility
Sickle cell preparation

UNIT III – Haematology
Total WBC count
Differential WBC count
Absolute eosinophil count
LEcell preparation
Bone marrow smear – preparation and staining
Iron stain
Peroxidase stain

UNIT IV – Clinical pathology
Urine – Sample collection
Complete urine analysis – physical, chemical – glucose, protein, reducing substances, ketone bodies, blood pigments, bile.
Urine sediments
Stool analysis

UNIT V – Clinical pathology
Body fluid analysis
CSF analysis
Semen analysis

References :

1. Clinical Diagnosis by laboratory methods – Todd and Sanford
2. Practical haematology – Dacie and Lewis
3. Clinical biochemistry – Teitz
4. Practical clinical biochemistry – Harold Varley
5. Harpers illustrated biochemistry – Murray, Granner, Mayes, Rodwell

II YEAR: PAPER 5
PRACTICAL: HAEMATOLOGY / CLINICAL PATHOLOGY / BLOOD BANKING - II

UNIT I – Haematology
Platelet count
Bleeding time, clotting time
PT and PTT

UNIT II – Blood Banking
Blood grouping
Blood cross match
Coomb's test

UNIT III – Biochemistry
Demonstration of Electrophoresis and Elisa
Revision of 1st year practicals

UNIT IV – Microbiology
Demonstration of agglutination, precipitation and complement fixation tests
Revision of 1st year practicals

UNIT V – Haematology / Clinical pathology / Blood banking
Demonstration of working of blood bank
Revision of 1st year practicals

References :

1. Clinical Diagnosis by laboratory methods – Todd and Sanford
2. Practical haematology – Dacie and Lewis
3. Clinical biochemistry – Teitz
4. Practical clinical biochemistry – Harold Varley
5. Harpers illustrated biochemistry – Murray, Granner, Mayes, Rodwell
6. Text book of medical laboratory technology – Praful Godhkar
7. Text book of microbiology – Ananthanarayanan and Jeyaram Panicker
8. Bailey and Scott's – Diagnostics microbiology – Finegole and Barbara

I YEAR: PAPER 6
PRACTICAL: HISTOPATHOLOGY AND CYTOLOGY

UNIT I
Processing
Fixation
Embedding
Microtomy

UNIT II

Stains – H & E
Special stains – AFB and Fite
Mounting of stains

UNIT III

Special stains – PAS, PASM and Masson's trichrome
Demonstration of frozen section

UNIT IV – Cytology

Smear preparation of FNAC
Fixation of smears

UNIT V – Cytology

Pap staining
Fluid cytology

References :

1. Culling – Histopathology techniques

NOTE : Practical examinations conducted in the 2nd year for the following subjects will include portions covered in the 1st year.

1. **Biochemistry**
2. **Microbiology**
3. **Haematology / Clinical pathology / blood banking**