SHIVAJI UNIVERSITY, KOLHAPUR.

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New Syllabus For

POST GRADUATE DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

To be implemented from June, 2012 onwards.

Shivaji University, Kolhapur

Revised Syllabus For Post Graduate Diploma In Medical Laboratory Technology

1. **Title of the Course :** P.G. Diploma in Medical Laboratory Technology
2. **Year of Implementation:** From June 2012 onwards.
3. **General Objectives of the Course :** The learner at the end of the course will –
   i. be able to work as technician in laboratories attached to hospitals under the supervisions of senior officers like Biochemist, Microbiologist or Pathologist. They may be employed in a small laboratory functioning independently or attached to a doctor's clinic. Nature of the job dictates that the candidate should give more emphasis on learning of practical skills along with a basic knowledge of the subject.
   ii. be able to carry out the routine tests in all these fields personally. He / She will maintain effective quality control and provide the patient with reliable reports.
   iii. Will acquire the necessary oriental knowledge and practical skill expected of him for the fulfillment of above objectives.
   iv. acquire theoretical knowledge and practical skill leading to further specialization in the elective field.
   v. appreciate and follow the ethical standards of the profession and will demonstrate qualities of honesty and accuracy towards his work and sympathy towards the suffering patients.
   vi. appreciate the limits of his ability and consult better qualified individuals when confronted with intricate problems.
4. **Duration :** One Year (Full Time)
5. **Pattern :** Annual
6. **Medium of Instruction :** English
7. **Structure of the Course :**

   i. Total number of papers : THEORY : 4
   PRACTICAL : 3

Sr.No.	PAPER NO.	TITLE OF THE PAPER	Total No of Lectures of 1 hr duration	No. of lectures (1 hr duration) per week
1.	Paper I	Anatomy, Physiology, Laboratory Management and Quality Control	80	2
2.	Paper II	Medical Biochemistry	80	2
3.	Paper III	Pathology	80	2
4.	Paper IV	Medical Microbiology	80	2
PRACTICALS				
1.	Paper I	Medical Biochemistry	-	3 hrs X 2 days
2.	Paper II	Pathology	-	3 hrs X 2 days
3.	Paper III	Medical Microbiology	-	3 hrs X 2 days

ii. Pattern of Examination: The examination shall be held for 700 marks. The break up shall be as follows.

Sr.No.	**Paper No.**	**Title of the Paper**	**Marks**	
			Theory	**Practical**
1.	Paper I	Anatomy, Physiology, Laboratory Management and Quality Control	100	-
2.	Paper II	Medical Biochemistry	100	100
3.	Paper III	Pathology	100	100
4.	Paper IV	Medical Microbiology	100	100

Theory examination for four subjects shall be conducted on separate days. Practical examination for three subjects will be conducted on three consecutive days.

iii. Standard of Passing :

a. Candidate must obtain 40 % marks in theory papers and practical papers separately.

b. There will be a separate head of passing for theory papers and practical. If candidate fails in one of the heads , he / she has to reappear only for the failed head.

c. On job training – The candidate has to complete the 'on job training' in any recognized clinical laboratory or institute or hospital , of a period of minimum 10 days in each of the practical subject.

iv. Qualification of the Examiners :

a. All examiners on the University panel for theory and practical should have Master degree in the relevant subject.

b. There will be two examiners (one internal and one external) for practical examination in each subject.

v. Nature of Question Paper (Theory) :

There shall be a question paper of 100 marks and three hours duration, for each subject. The paper shall be of following nature -

1.	Objective type question (Multiple Choice Type-10 & True / False Type - 10)	20
2.	Descriptive Questions (2 out of 3)	20
3.	Descriptive Questions (2 out of 3)	20
4.	Short Answer Type Questions (4 out of 6)	20
5.	Short Note Type Questions (4 out of 6)	20

8. Other features :

1. **Eligibilty:** Candidate should have a B.Sc. degree of Shivaji University with Microbiology, Chemistry, Botany, Zoology or Biotechnology as the principal subject or a equivalent qualification of other recognized University.
2. Candidates offering vocational M.L.T. or C.M.L.T. as a subject at HSC (XII) level may be given preference.
3. Admission to the course should be done once in a year. The course will begin in the month of July , each year (After declaration of B.Sc. results of all Nonagricultural Universities) and will extend over two academic terms – July to October and November to April.
4. University examination for DMLT will be conducted at the end of the course i.e. after completion of two academic terms. For failed candidates, midterm examination will be conducted in month of October or November.

9. Essential Requirements :

i. Lecture hall with all essential facilities.

ii. Collaboration with minimum five pathological laboratories for practical experience.

iii. Laboratory :

a. One laboratory of minimum size of 400 Sq. ft. for a batch of 20 students.

b. One working table of size 6’ x 2½’ per two students.

c. Arrangements for gas supply and fitting of two burners per table.

d. At least one wash basin for a group of five students

e. One separate sterilization and washing room attached to the laboratory(10’x10’).

f. One separate instrument room attached to the laboratory (10’ x 10’).

g. One separate media and reagent preparation room attached to the laboratory (10’ x 10’)

iv. Equipments in the laboratory :

a. Hot air oven - 1
b. Incubator - 1
c. Autoclave - 1
d. Refrigerator - 1
e. Medical microscopes (Binocular) -10
f. Chemical balance - 2
g. pH meter - 1
h. Centrifuge - 2
i. Colorimeter - 1
j. Magnetic stirrer - 1
k. Colony counter - 1
l. Water bath - 1
m. Micropipettes (10 to 200 µl) -
n. Haemocytometer - 2
o. Haemoglobinometer - 2
p. ESR Units - 2
q. ELIZA Reader - 1
r. Microtome with knives - 1
s. Staining racks

v. Glassware, chemicals and reagents – As per the requirements of practicals in the syllabus.

vi. Laboratory Safety Equipments-

a. Fire extinguisher
b. First aid kit
c. Fumigation chamber
d. Stabilized power supply
e. Insulated wiring for electric supply.
f. Good valves & regulators for gas supply.
g. Operational manuals for instruments.
h. Emergency exits.

vii. **Library :** With books as per recommended list.

THEORY :

Paper I : Anatomy, Physiology, Laboratory Management and Quality Control

1. **Introduction:** **05**

   Different systems of Human body, Cell- Structure & function; Body Tissue – their functions, Common anatomical terms (Anterior/Ventral, lateral, medial, median, posterior/dorsal etc.), Anatomical Position & Planes (Supine, prone, recumbent, lithotomy) planes- coronal, sagittal.

2. **Cardio Vascular System:** **08**

   Structure of Heart & its coverings, Major Blood vessels- arteries & veins, Pulmonary circulation - portal and systemic circulation. Blood pressure, factors affecting it, Cardiovascular diseases- hypertension, Congestive Cardiac Failure, Ischemic heart disease.

3. **Respiratory System:** **08**

   Respiratory tract structure, Lungs structure, Mechanism of respiration, Vital Capacity. Introduction to Respiratory Diseases like Tuberculosis, Pneumonia, Asthma, ARDS, Respiratory failure, carcinoma.

4. **Central Nervous System:** **08**

   Brain – Central and peripheral nervous system. Introduction to central nervous system diseases - Stroke, Alzheimer's disease, Epilepsy, Myasthenia Gravis Parkinson's disease.

5. **Digestive Systems (G. I. T) :** **10**

   Digestion - definition, mouth cavity, oesophagus, stomach, small and large intestine, rectum, anus, liver , pancreas, physiology of digestion. Introduction to bowl diseases like - Gastric ulcer, Carcinoma, Inflammatory Bowel disease, Liver - Cirrhosis Cholelithiasis and Pancreatitis.

6. **Urinary System :** **12**

   Structure and functions of kidney and lower urinary tract. Mechanism of urine formation, Introduction to common kidney diseases like Urolithiasis and Renal failure. Maintenance of acid-base balance and electrolyte balance. Testis- Vas deferens, prostate, Seminal vesicles; Ovaries, uterus, vagina Diseases- Menopause, carcinoma.

7. **Reproductive System :** Structure of male and female reproductive system. **05**

8. **Endocrine Glands :** **05**

   Physiology, hypo and hyper activity of thyroid and pancreas.

9. **Laboratory :** **06**

   Introduction and planning. Role of laboratory in human health and diseases, Human diseases and methods of diagnosis, Laboratory at different level (National / State / District), Duties and responsibilities of laboratory personnel , Laboratory services as a backbone of health care delivery system. General principles , Laboratory goals, Space requirements, Designing of laboratory sections.

10. **Care of laboratory glassware , chemicals , equipments and instruments -** **05**

    General Principles, Care and Cleaning of Glassware, Care of equipment and apparatus, Laboratory chemicals – Proper use, care, storage and labeling, Specimen handling, Appropriate container, Method of collection, Method of transportation, Method of preservation and disposal of laboratory waste .

11. **Laboratory Safety -** General principles of safety programmes, First aid and safety measures for Mechanical, Electrical, Chemical, Radioactive and Biological hazards; Universal safety precautions. **05**

12. **Laboratory Quality control and quality assurance.** **03**

    Internal and external quality control programmes.

Reference Books:

1. Handbook of Christen Medical Association, India (CMAI) Medical Laboratory Technology- Robert H. Carman. 2nd Edn. CMAI, New Delhi.
2. Text book of Medical Laboratory Technology, P.B. Godkar 2nd Edn. 2003 Bhalani Publication.
3. Human Physiology (Vol. I, IV) C.C. Chatterjee 1992. 11th Edn. Medical Allied Agencies, Calcutta.
4. Human Anatomy (3- Vol) B.D. Chaurasia. 1995 .3rd Edn. CBS. New Delhi.
5. Cunningham's Manual of Practical Anatomy (3- Vol) Cunningham 1986 15th ELBS Oxford University.
6. Laboratory Setup & Procedures , G. Guru, 1st Edn. 1989 NCERT, New Delhi
7. Biosafety Manual for laboratories, WHO, Geneva, 2nd Edn. 1993 . WHO Publication, Geneva.

Paper II : Medical Biochemistry

1. **Introduction -** Atomic weight, molecular weight and equivalent weight ; Acids, bases and salts; pH indicators, pH meter, pH measurement; Solutions - Molar , Normal Buffer , Percent , Saturated and Standard .Principles, working, uses, care and maintenance of (a) Balances (b) Centrifuges, (c) pH meter (d) Colorimeter, (e) Spectrophotometer, (f) Flame-photometer, (g) Electrodes (h) Electrophoresis. **10**
2. **Carbohydrates:** Definition, Classification, Functions, Properties, Dietary Sources, digestion, absorption, basic metabolism, regulation of blood glucose & its importance, glucose tolerance test, glucocylated Hb, other parameters. **12**
3. **Lipids:** Definition, Classification , Functions, Dietary sources, digestion, absorption, basic metabolism, lipid profile (cholesterol, triglyceride, lipoproteins, phospholipids) and its significance in various disorders. **12**
4. **Proteins:** Definition, Classification , Functions, Dietary sources, digestion, absorption, fate of amino acids, formation and detoxification of ammonia, formation of urea, formation of non protein nitrogenous products e.g. uric acid, creatinine, disorders related to protein and nitrogen metabolism. **12**
5. **Enzymes**: Definition, Classification, properties, factors affecting enzyme activity, isoenzymes and coenzymes. **Clinical Enzymology :** Therapeutic, diagnostic and analytical uses of enzymes with normal values of serum enzymes. **09**
6. **Nucleic acids :** Definition, Types and Functions. **05**
7. **Hormones :** Types and biochemical functions. **05**
8. **Minerals and Electrolytes:** Na, K, Cl ,Ca, Mg, I_2, P, Fe and iron binding capacity.**05**
9. **Acid-Base Balance**: Regulation of blood pH, renal, respiratory and buffer system, importance of arterial blood gases. **05**
10. **Organ Profiles** - Liver function test, Kidney function test, Thyroid function test, Cardiac function test, Pancreas function test, Hypertension profile, Diabetic profile, Gastric function test. **05**

Reference Books :

1. Handbook of Christen Medical Association, India (CMAI) Medical Laboratory Technology- Robert H. Carman. 2nd Edn. CMAI, New Delhi.

2. Text book of Medical Laboratory Technology, P.B. Godkar 2nd Edn. 2003 Bhalani Publication.
4. Handbook of Biochemistry, M. A. Siddique 8th Edn.1993 Vijay Bhagat Scientific Book Co., Patna.
4. Text book of Medical Biochemistry, S. Ramkrishnan 1st Edn. 1980 Orient Longman Ltd., Madras.
5. Biochemical Techniques, K. Choudhary 1st Edn.1989, Medical Publishers, New Delhi.
6. Clinical Biochemistry, G. Guru 1st Edn.1989, Secretary, National Council of Educational Research & Training, New Delhi.

Paper III: Pathology

1. Haematology: 20

i. Introduction - Composition of blood, its formation and functions

Collection of blood - Different routes, difference between capillary and venous sample. Anticoagulants - Different types, method of preparation and uses.

ii. Haemoglobin - Normal and abnormal values and Physiological variations; Estimation by (a) Colorimetric Method, (b) Sahli's Method, and (c) Specific Gravity Method. Clinical importance.

iii. Red Blood Cells : Total Count - Normal, abnormal values, and Physiological variations, Haemocytometer - method and calculation; Anemia – Classification, Sickle cell anemia – Sickling test, Haematocrit – Normal and abnormal values, Red Cell indices – Normal and abnormal values, Erythrocyte Sedimentation Rate-Westergrens & Wintrobe's Method and Factors affecting the values, Limitations and Significance,

iv. White Blood Cells : Differential Count :- Normal, abnormal values and physiological variation; Preparation of peripheral blood smear, Staining by different methods, Methods of Examinations and reporting; Total White Blood Cell Count : Normal and abnormal values; Haemocytometer - method and calculation ;

v. Reticulocytes : Methods, Normal values and significance.

vi. Haemostasis and Coagulation Mechanism- Coagulation Factors, Coagulation Test – (a) Bleeding time, (b) Clotting time, (c) Whole Blood Coagulation time, (d) Tourniquet test,(e) Clot retraction test (f) Prothrombin time (PT), (g) Activated Partial Thromo Plastin time (APTT) , L. E. Cell test.

viii. **Bone Marrow :** Smear Preparation, Staining, Examination and Report

2. Blood Banking : 20

i. Introduction to Immunohematology, Human blood group antigens.

ii. ABO blood group system. - Sub groups, Source of antigens.

iii. Rh blood group system.

iv. Introduction to other blood group systems.

v. Technique of blood grouping and cross matching.

vi. Coomb's test - Direct and Indirect test.

vii. Blood transfusion technique- (a) Anticoagulant solution,(b) Criteria for selection of donor, (c) Screening test for donor, (d) Method of collection of blood.

viii. Investigation of transfusion reaction. Hemolytic disease of newborn, Transfusion transmitted diseases.

ix. Cell preparation and transfusion of various components of blood.

3. Clinical Pathology : 20

i. Examination Of Urine - Indication, Collection, Container, Transport, Preservation of urine for different types of urine analysis; Physical, Chemical and Microscopic examination of urine and its significance.

ii. **Examination Of Stool -** Indication, Collection, Container, Transport, Preservation for different types of fecal analysis; Physical, Chemical and Microscopic examination and its significance.

iii. Examination Of Sputum - Indication, Collection, Container, Transport, Preservation for different types of sputum analysis; Physical , Chemical and Microscopic examination and its significance.

iv. Semen Analysis - Indication, Collection, Container, Transport, Preservation for different types of semen examination; Physical Chemical and Microscopic examination and its significance.

v. CSF and other body fluids - Indication, Collection, Container, Transport, Preservation for different types of CSF and other body fluids; Physical Chemical and Microscopic examination and its significance.

4. Histopathology : 10

i. Introduction & importance of histopathology.

ii. Tissue Fixatives.

iii. **Tissue Processing -** Collection of specimen, Labeling and fixation, Dehydration , Clearing, Impregnation, Embedding.

iv. **Section Cutting** - Microtome and microtome knives, sharpening and care, technique of section cutting, mounting of sections, frozen sections and cryostat.

v. **Staining :** Theory of staining, Types of staining, Basic staining – Hematoxylin and Eosin (H&E),Mounting of sections, Common special stains PAS, Masson trichrome and Geimsa.

vi. Decalcification, Detection of end point, Neutralization and processing

5. Cytopathology : 10

i. **Introduction -** Cytology and cytopathology, Method of specimen collection and transportation for gynecological samples, Method of specimen collection, transportation and preservation of non-gynecological samples; Fixation and fixative - Common fixative, Special purpose fixative.

ii. **The Papanicolaou stain and staining method.**

Reference Books:

01. Text Book of Medical Laboratory Technology, P.B. Godkar,2nd Edn.2003. Bhalani Publication.
02. Handbook of Christen Medical Association, India (CMAI) Medical Laboratory Technology- Robert H. Carman. 2nd Edn. CMAI, New Delhi.
03. Practical Haematology, John Dacie & S. M. Lewis 8th Edn.1995 Churchil Livingston.
04. Clinical Haematology, Maxwell M.Wintrobe, 8th Edn.1981 Lea & Febiger – Philadephia.
05. Blood Bank Operations, G. Guru 1st Edn.1991, NCERT, New Delhi.
06. Blood Banking Training Manual, Indian Society for Blood Banking, 1st Edn.1995,Dr. Dilip Wani, Janakalyan Bldg. , Pune.
07. Text Book of Medical Laboratory Technology, P.B. Godkar,2nd Edn.2003. Bhalani Publication.
08. Medical Laboratory Techniques, Vol - I, II & III, K. Mukharji 5th Edn. 1988 Tata McGrawHill , Delhi.
09. Histotechnology , G. Guru, 1st Edn. 1988. NCERT, New Delhi.
10. Hand Book of Histotechnological & Histochemcial Techniques , C. F. A. Culling, 3rd Edn. 1974, Butterworth – London.

11. Diagnostic Cytology, Vol - I & II, L. G. Koss, 3rd Edn. 1979 J. B. Lippincott Co., Philadelhia.
12. Exfoliated Cytology, E. G. Wachtel, 1st Edn. 1964. Butterworth, London
13. Text Book of Histopathology, Bancroft.

Paper IV: Medical Microbiology

1. Bacteriology 30

i. Introduction to Medical Microbiology – Classification, morphology and physiology of bacteria. Normal flora of human body.

ii. Common methods of sterilization and disinfection.

iii. Cultivation of bacteria - Bacterial growth requirement.

iv. Common media - Classification, preparation, sterilization and uses.

v. Culture methods – sample collection, transportation, steps in processing the sample, choice of medium, methods of plating and isolation and subculturing.

vi. Pyogenic cocci – Morphology, pathogenicity and method of isolation of *Staphylococci, Streptococci and pneumococci, Niesseriae.*

vii. Gram Negative Bacilli – Morphology, pathogenicity and method of isolation of *Escherichia coli, Klebsiella , Proteus, Pseudomonas, Salmonella, Shigella, Vibrio etc.*

viii. Gram positive Bacilli and Anaerobes - Morphology, pathogenicity and method of isolation of Corynebacteria & Bacillus spp., Clostridial and Non- Clostridial anaerobes.

ix. Morphology, pathogenicity and method of isolation *of M. tuberculosis, Atypical mycobacteria and M. leprae, Actinomyces, Nocardia, Ricketssia, Chlamydia etc.*

x. Spirochaetes - Treponema, leptospira and other miscellaneous microbes of medical importance, Kahn test, Rose-Waller test.

xi. Antimicrobial susceptibility test

2. Immunology and Serology 20

i. Immunity - Introduction, types of immunity, Antigen, Antibody and Complement.

ii. Antigen antibody reaction and common serological reactions.

ii. Humoral and cell mediated immunity

iv. Auto immunity and Auto-immune diseases

v. Immune deficiency diseases and it's investigation **(HIV).**

3. Parasitology **15**

i. Morphology, Life-cycle, Pathogenicity and Laboratory diagnosis of protozoa such as : (a) *E. histolytica and Entamoeba coli,* (b) *Giardia*,(c) *Trichomonas*,(d) *Toxoplasma*,(e) *Plasmodia and Leishmania*

ii. Morphology, Life-cycle, Pathogenicity and Laboratory diagnosis of following helminthes and nematodes : (a) Hook worm, Round worm, Whip worm, Thread worm, Pin worm. (b) Tapeworm and *Echinococcus (c) Wucheria bancrofti and B. malayi.*

4. Mycology : Morphology and laboratory diagnosis of superficial mycosis and deep Mycosis. . **08**

5. Virology : Morphology, pathogenicity and laboratory diagnosis of Hepatitis, AIDS and Oncogenic viruses. **07**

Reference Books :

1. Text book of Medical Microiology, R. Ananthnarayan & C. K. Jairam Panikar 5th Edn. Orient Longman, Madras.
2. Handbook of Christen Medical Association, India (CMAI) Medical Laboratory Technology- Robert H. Carman. 2nd Edn. CMAI, New Delhi.
3. Text book of Medical Laboratory Technology,P.B.Godkar 2nd Edn.2003 Bhalani Publication.
4. Medical Microbiology -Vol.I & II, Mackie-McCartney, 3thEdn. ELBS, Churchil Livingstone.
5. Medical Microbiology- Earnest Jawetz , 18th Edn. Prentice – Hall International Inc - USA
6. Essential Immunology, I. M. Roitt, 6th Edn. ELBS, London.
7. Immunology - An outline for students of medicine , D. M. Weir ,5th Edinburgh, Churchil Livingston.
8. A Hand book of Practical Immunology, G. P. Talwar, 1st Edn. Vikas Publishing House.
9. Serology for Medical Laboratory Students, G. Guru, 1st Edn. NCERT, NewDelhi.
10. Serology, Tulip Dignostic Syphillis, 1st Edn. Tulip Dignostic, Germany
11. Clinical Diagnosis & Management,Todd-Stanford,19th Edn.W.B.Saunders.Co.U.S.A.
12. Parasitology - K. D. Chatterji ,11th Edn. 1976 Chatterji Medical Publisher, Kolcata
13. Medical Mycology, J. W. Rippon, 3rd Edn.1988W. B. Saunders Co., London.

14. Mycology for Clinical Laboratory, G. M. More & D. M. Jacio, 1st Edn. 1979. Reston Publishing Co., USA.
15. Medical Virology, D.O.White & F.Fenner, 3rd Edn.1986.Academic Press, New York.
16. Text book of Human Virology, R. B. Bleshe, et. al. 2nd Edn. 1991St. Louis Mosby, Year Book.

Practical Course

Paper I : Medical Biochemistry

1. Principles and working of laboratory instruments
2. Importance and methods of cleaning of glass apparatus
3. Calibration of apparatus and glass-wares
4. Preparation and standardisation of volumetric solutions.
5. Preparation of buffer solutions and measurement of their pH
6. Estimation of Blood sugar / glucose – GOD-POD method.
7. Estimation of Urea- DAM method.
8. Estimation of Plasma protein – Biuret method.
9. Estimation of serum Bilirubin- Diazo method.
10. Estimation of serum Uric acid
11. Estimation of serum Creatinine
12. Estimation of serum Cholesterol
13. Estimation of serum HDL Cholesterol
14. Estimation of serum Triglyceride
15. Estimation of serum Calcium and ionic Calcium.
16. Estimation of serum Chloride
17. Estimation of serum Sodium and Potassium (by flame photometer)
18. Estimation of serum Transaminases (SGOT & PT)
19. Estimation of serum Amylase
20. Estimation of serum Acid phosphatase
21. Estimation of serum Alkaline phosphatase

Paper II : Pathology

1. Haemoglobin Estimation – Sahli's and Drabkin's Method
2. RBC Count
3. Total WBC Count
4. Differential WBC Count
5. Absolute Eosinophil Count
6. Reticulocyte count

7. E.S.R. determination
8. Platelet Count
9. Bleeding time and clotting time
10. Prothrombin time / Partial Thromboplastin time
11. L. E. Cell Preparation
12. Sickle Cell Preparation
13. Bone Marrow Smear Preparation, Staining and Examination
14. ABO Grouping (a)Slide technique, (b) Tube technique, (c) Reverse and forward grouping
15. Cross matching – Major and Minor
16. Rh typing - Slide and tube test.
17. Coombs test (a) Direct coombs, (b) Indirect coombs
18. Routine examination of urine
19. Routine examination of stool
20. Routine examination of sputum
21. Routine examination of semen
22. Routine examination of CSF / Fluid
23. Fixation, Processing, Embedding, Section cutting and preparation of slides
24. Sharpening of Knives
25. Preparation of fixative and decalcifying fluid
26. Collection, Preparation, Fixation and staining of cytological smears by Papanicolaou's staining method.

Paper III : Medical Microbiology

1. Microscope – Parts and functions, Care , use and practice.
2. Staining techniques - Monochrome, Gram, Acid fast and Albert .
3. KOH preparation
4. Hanging drop technique for motility.
5. Common Culture media : Liquid and solid - Preparation, Sterilization, and uses
6. Biochemical tests for identification of pathogens – sugar fermentation and H_2S production
7. Antibiotic susceptibility testing by Kirby-Bauer method
8. Widal test, Weil – Felix test, RPR/VDRL test, R.A. test, CRP test.
9. ASO test, Pregnancy test, Mauntoux test.
10. Enzyme Linked Immuno Sorbent assay (ELISA) – HIV and Austrelia antigen test.
11. Collection, Preservation and Transportation of fecal material and its Physical, Chemical & Parasitic examination

12. Preparation of stained and unstained slide for detection of larvae / ova or cysts
13. Concentration methods for Ova & Cysts.
14. Demonstration of gross specimen of Hookworm, Roundworm, Whip worm, Thread worm, Pin worm and Tape worm,
15. Demonstration of following parasites / ova / cyst under microscope :
    G. lamblia, (b) *T. vaganalis*, (c) Malerial parasites, (d) *Leishmania*, (e) Roundworm, (f) Whipworm, (g) Threadworm, (h) Pin worm and (i) Tapeworm.

References :

3. Handbook of Christen Medical Association, India (CMAI) Medical Laboratory Technology- Robert H. Carman. 2nd Edn. CMAI, New Delhi.
4. Text book of Medical Laboratory Technology, P.B. Godkar 2nd Edn. 2003 Bhalani Publication.
5. Medical Laboratory Technology – Ramnik Sood.

Practical Examination :

i. There will be a separate practical examination of 100 marks for each practical course.

ii. Examination for three subjects will be conducted on three consecutive days separately.

iii. The examination will be of six hours duration for each subject.

iv. Student should submit duly certified Journal and 'On Job Training Report' at the time of Practical Examination.

v. Nature of Practical Question Paper for all the practical courses will be as follows-

1. Major Experiment (with Internal Options)	20 Marks
2. Major Experiment (with Internal Options)	20 Marks
3. Minor Experiment (with Internal Options)	10 Marks
4. Minor Experiment (with Internal Options)	10 Marks
5. Spotting	10 Marks
6. Viva -voce	10 Marks
7. Journal	10 Marks
8. On Job Training Report	10 Marks

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