DEPARTMENT OF ADVANCED ZOOLOGY AND BIOTECHNOLOGY

M.Sc. Medical Laboratory

P.G. PROGRAMME

SYLLABUS

Effective from the Academic Year 2012-2013

Loyola College (Autonomous)

Chennai- 600 034

LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI - 600 034.

M.Sc MEDICAL LABORATORY TECHNOLOGY

RESTRUCTURED CBCS CURRICULUM – PHASE IV
EFFECTIVE FROM 2012-13

Strength

1. Loyola College (Autonomous), Chennai, Tamil Nadu offers M.Sc programme in Medical Laboratory Technology under choice based credit system. The duration of the course is two academic years consisting four semesters.
2. Innovative and multidisciplinary course with specific career opportunities and incorporates programmes and techniques to satisfy new / fresh demands.
3. The curriculum is based upon human needs and structured to make educational sense to students, creative and intellectual satisfaction to the teachers and managerial sense to those responsible for administration.
4. In addition to Summer Training Programme **(**STP)**, internship (outside class hours) in medical / paramedical industry during II, III and IV semesters is mandatory. INTERNSHIP OF 360 hours and ONE RURAL MEDICAL CAMP SHALL BE MENTIONED IN MARK STATEMENT.**
5. Due weightage is given for lab courses (28 credits; 38 hours) in I, II and III semesters and Project and Dissertation component in IV semester (10 credits; 14 hours).
6. Inter-disciplinary paper (ID) with Department of Statistics is included.
7. **Life Skill Training** (2C; 2h+2h) and **Self Study** (2C) components are introduced.
8. Curriculum satisfies industrial and societal needs.

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EFFECTIVE FROM 2012-13

SEM	MC (79C104h)	ES (3Cx2=6 C) 8h	ID (5C6h)	*Internship (out side class hours)	SSP (2C)	STP (1C)	LST (2C)2h+2h	LEAP(3C)	TOTAL Credits and Hours
I	**20C** 30h							60h+ Rural Camp **3C**	**20C 30h**+60h
II	**20C** 24h	**3C** 4h		***Internship I (+120h)**			**2C** 2h+2h*		**23C+2C+3C 30h+2h+R.camp (+120h)**
SUMMER VACATION						**1C 120h**			**1C** + 120h
III	**15C** 20h	**3C** 4h	**5C** 6h	***Internship II (+120h)**	**2C**				**23C** + **2C 30h** (120h)
IV	**24C** 30h			***Internship III (+120h)**					**24C 30h** (120h)
Total	**79C** 104h	**6C** 8h	**5C** 6h	**Internship & rural medical camp (+360h)**	**+2C**	**+1C** 120h	**+2C** 2h+2h	**+3C** 60h+ Camp	**90C** + **6C** +2C **120h** + 2h (360h)

MC-Major Core, **ES**-Elective Subject, **ID**-Interdisciplinary, **SSP**-Self Study Paper, **LST**-Life Skills Training**, LEAP**-Loyola Extension Awareness Programme, **+h** – Outside Class Hours, **STP**- Summer Training Programme.

***Internship I** : During semester II (Nov to March= 120h) out side class hours

***Internship II** : During semester III (July to Oct= 120h) out side class hours

***Internship III** : During semester IV (Nov to Mar= 120h+ Rural Medical Camp) out side class hours

- **Internship I, II and III are mandatory.**
- **Internship to be monitored and assessed by respective guides.**
- **Certified completion report to be submitted to CoE through the Coordinator.**
- **Successful completion of internships shall be recorded in the respective semester and cumulative grade sheet/ mark statement.**

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EVALUATION

1. Major core (MC), Elective subject (ES) and Inter-disciplinary (ID) papers shall be assessed through continuous internal assessment tests (CA) and semester examination (SE). Equal weightage of marks for CA (50marks) and SE (50 marks) is awarded, and added together for aggregate (100 marks).

    a. Semester Examination shall be 3 hours duration for theory papers and 4 hours duration for Lab Courses/Practical.

    b. CA component shall have two organized tests evenly spread over the semester with 70% weightage. Remaining 30% weightage shall be from snap tests, class seminars, written assignments on selected topics, tutorials, quiz, open book test and other such assignments, continuously throughout the semester.

2. Participation in Loyola Extension Awareness Programme(LEAP) is mandatory and shall be assessed continuously based on the completion of required number of hours of participation (60hours) in the activities set and defined by appropriate academic forum during I semester and participation in the rural camp held during II semester. Organized and monitored by OUTREACH department. Certified completion report shall be submitted to CoE through the Director, OUTREACH.

3. Self Study Paper (SSP) and Life Skill Training (LST) shall be assessed through Continuous Assessment. There shall be no semester examination.

4. Summer Training Programme (STP) conducted outside class hours shall be monitored and assessed continuously by respective guides and supervisors. Certified completion report is to be submitted to CoE through the Co-ordinator.

5. Internship I, II and III conducted outside class hours during the course of semester II, III and IV respectively shall be monitored and assessed continuously by respective guides and supervisors. Successful completion of internships I, II and III shall be recorded in the respective semester and cumulative grade sheet/ mark statement.

M.Sc Medical Lab Technology: Restructured CBCS Curriculum Phase IV Effective From 2012-13

SEMESTER-I

Code	Course	C	H	Credits (h per week)	CA (50)	SEM (50)	Aggregate (100)
MAJOR CORE (MC) PAPERS							
ML 1811	Fundamentals of Medical laboratory technology	3	3	**20C (30h)**	✓	✓	✓
ML 1812	Human anatomy and Physiology	3	5		✓	✓	✓
ML 1813	Molecular biology and Clinical biochemistry	3	5		✓	✓	✓
ML 1814	Haematology	3	5		✓	✓	✓
ML 1815	Molecular Biology and Biochemistry lab course	4	6		✓	✓	✓
ML 1816	Haematology lab course	4	6		✓	✓	✓
Loyola Extension Awareness Programme (LEAP)		**60h Outside class hours**		**Contd in II sem**			✓
TOTAL CONTACT HOURS AND CREDITS		**20**	**30**				

SEMESTER –II

Code	Course	C	H	Credits (h per week)	CA (50)	SEM (50)	Aggregate (100)
	MAJOR CORE (MC) PAPERS						
ML 2814	Medical Microbiology	5	6	**20C (24h)**	✓	✓	✓
ML 2815	Immunology	5	6		✓	✓	✓
ML 2816	Serology and Blood bank lab course	5	6		✓	✓	✓
ML 2817	Microbiology lab course	5	6		✓	✓	✓
	ELECTIVE SUBJECT (ES) PAPER						
ML 2955	Research Methodology (OR)	3	4	**3C (4h)**	✓	✓	✓
ML 2956	Community Medicine and Epidemiology						
FS 2926	**LIFE SKILL TRAINING (LST)**	2	2+2	**2C (2h+2h)**			✓
LEAP (RURAL CAMP)		**3**		**3C**			✓
TOTAL CONTACT HOURS AND CREDITS			**30+2**	**25+3**			
INTERNSHIP I			**+120h (outside class hours)**				✓
SUMMER TRAINING PROGRAM (STP)		**1**	**120h**	**1C (120h)**			✓

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SEMESTER –III

Code	Course	C	H	Credits (h per week)	CA (50)	SEM (50)	Aggregate (100)
	MAJOR CORE (MC) PAPERS:						
ML 3811	Fluid Analysis and Human Disorders	5	6	**15C (20h)**	✓	✓	✓
ML 3812	Urine Analysis, Stool Examination Lab Course	5	7		✓	✓	✓
ML 3813	Seminal and Sputum Analysis Lab Course	5	7		✓	✓	✓
	ELECTIVE SUBJECT (ES) PAPER						
ML 3953	Hospital Management (OR)	3	4	**3C (4h)**	✓	✓	✓
ML 3954	Forensic Science and Toxicology						
	INTERDISPLINARY (ID) PAPER (with Dept. of Biomedical Instrumentation Science)						
ML 3875	Modern Medical Practices and Ethics	5	6	**5C (6h)**	✓	✓	✓
SSP	**SELF STUDY PAPER (SSP)**	2	Outside Class Hours	**2C (2h+2h)**			✓
TOTAL CONTACT HOURS AND CREDITS		**23+2**	**30**	**23C+2C 30h+2h**			
INTERNSHIP II			**+120 h (outside class hours)**				✓

ML 3301 CLINICAL TECHNIQUES as elective general (EG 1) with one credit and 3 hours weightage for undergraduate students of Shift II.

SEMESTER –IV

Code	Course	C	H	Credits (h per week)	CA (50)	Sem (50)	Aggregate (100)
MAJOR CORE (MC) PAPERS							
ML 4814	Non Invasive Techniques	5	5	**24C (30h)**	✓	✓	✓
ML4815	Separation Techniques and Pharmaceutical Chemistry	5	6		✓	✓	✓
ML 4816	Histopathology and Modern Diagnostics	4	5		✓	✓	✓
ML 4817	Project and Dissertation	10	14		✓	✓	✓
TOTAL CONTACT HOURS AND CREDITS		24	30				
INTERNSHIP III & RURAL MEDICAL CAMP			**+120h (outside class hours)**				✓
Grand Total		120+2h (90C+6C+2C)					

ML 4301 LIFE STYLE DISORDERS as elective general (EG 2) with one credit and 3 hours weightage for undergraduate students of Shift II.

ML 1811 FUNDAMENTALS OF MEDICAL LABORATORY TECHNOLOGY

SEMESTER	**: I**	**CREDITS**	**: 03**
CATEGORIES	**: MC**	**NO. OF HOURS/ WEEK**	**: 03**

Objectives:

- *To understand the role of Healthcare Professionals.*
- *To impart basic knowledge on laboratory principles, procedures and techniques*

UNIT: I

Basic laboratory principles - Code of conduct of medical laboratory personnel - Organization of clinical laboratory - Role of medical laboratory technician - Safety measures - Medical laboratory professional and professionalism in laboratory workers - communication between physician and lab technician - hospital and clinic borne infection and personnel hygiene

UNIT: II

Common glass wares in clinical laboratory - care and maintenance - Calibration of pipettes and volumetric apparatus - Cleaning and sterilization methods - antiseptics and disinfectants - Principle, care, maintenance and application of Light - Fluorescent - Phase contrast - Electron microscope – staining techniques – vital stains

UNIT: III

Laboratory instruments: Introduction - Chemical balance: types, principle and practice -– Photometry- Principles and use- Beer Lambert law – Wavelength, transmittance and absorbance – Centrifuges - Water bath – Refrigerator – Autoclave - Hot air oven – Mixer – Laminar air flow - Water distillation unit (De ionized and double distilled water)- Automation.

UNIT: IV

Clinical samples and specimens - Specimen collection, transport, storage and disposal –common laboratory infections - Anticoagulants: EDTA, Di-potassium salts of EDTA, double oxalate, single oxalate, sodium citrate and sodium fluoride.

UNIT: V

Acid - Base balance – Electrolytes - Buffer and pH- Preparation of solution : Normal , per cent and Molar solution - normal saline -Methods of measuring liquids- Clinical laboratory records- Modern laboratory set up - Quality control: Accuracy, Precision, and Reference values.

TEXT BOOKS

1. Mukerjee, K. L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume I, McGraw Hill, New Delhi.
2. Sood.R., 2006. Textbook of Medical Laboratory Technology, Jaypee, New Delhi.

REFERENCE BOOKS

1. Fischbach, F.T. and M.B. Dunning, 2009. A Manual of laboratory and Diagnostic Tests, Lippincott Williams Wilkins, New York.
2. Sonnenwirth, A.C. and L. Jarret, 2000 Gradwohls' Clinical laboratory methods and diagnosis. M.D.B.I., New Delhi.
3. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice, McGraw Hill, New Delhi.

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ML 1812 HUMAN ANATOMY AND PHYSIOLOGY

SEMESTER	**: I**	**CREDITS**	**: 03**
CATEGORIES	**: MC**	**NO. OF HOURS/ WEEK**	**: 05**

Objectives:

- *To identify and relate basic concepts of structure and functions of cells, tissues and organs.*
- *To understand the anatomical organization, coordination and integrated functions of human body.*

UNIT I:

Human Body an overview- Directional and regional terms - Cavities and planes, Tissues: Structure, function and locations of epithelial, connective and nerve tissues. Skin: Structure, function and pigmentation- Skeletal System: axial and appendicular skeleton functions, anatomy, histology, Structural and functional classification of joints and movements.

UNIT II: Digestive System: Gross anatomy, gastrointestinal secretions and function- Respiratory system: Anatomy of respiratory organs and functions, mechanism and regulation of respiration, respiratory volumes and capacities- Circulatory system: Functions of circulatory system, Heart structure, Circulatory routes (systemic, pulmonary, coronary and portal circulation) and Blood vessels- Lymphatic system: structure and function.

UNIT III: Endocrine System: Basic anatomy and physiology of the Pituitary, Thyroid, Parathyroid, Adrenals, Pancreas, Testes and ovary, their hormones, functions and disorders.

UNIT IV: Central nervous system: Brain- structure, location and functions- Spinal Cord: Anatomy, functions, reflex- arc- meninges- Peripheral nervous system – Cranial and spinal nerves- Autonomic nervous system (Physiology and functions) - structure of neuron- synapse- transmission of nerve impulse- Sense Organs: Basic anatomy and physiology of eye, ear, taste buds, tactile and olfactory sense organs- Muscular system: Types of muscles, Mechanism of muscle contraction.

UNIT V: Excretory system: structure and function - Physiology of urine formation. Reproductive System: structure and function of testis, ovary and associated glands- spermatogenesis and oogenesis- hormonal

regulation of reproduction.

TEXT BOOKS

1. Derrickson,B.H., 2011. Principles of Anatomy and Physiology, Harper Collins, New York.

2. Sarada, S. and M. Kutty, 1995. Textbook of Physiology, Orient Blackswan, Hyderabad.

3. Tortora, G.J. and Waugh, A. and Grant. A, 2010. Ross and Wilson Anatomy and physiology in health and illness, Elsevier, New Delhi.

REFERENCE BOOKS

1. Costanzo,L.S., 2007, Physiology, Williams and Wilkins, New York.
2. Guyton, A.C. and J.E. Hall, 2010. Textbook of Medical Physiology, Elsevier, New Delhi.
3. Johnson, L.R., 2003. Essential Medical Physiology, Elsevier, New Delhi.
4. Stanfield, C.L., and W.J. Germann, 2010. Principles of Human Physiology, Pearson/Benjamin Cummings, California.
5. Thibodeau, G.A., and C.P.Anthony, 2006. Text book of Anatomy and Physiology, Mosby, United states.

ML 1813 MOLECULAR BIOLOGY AND CLINICAL BIOCHEMISTRY

SEMESTER	**: I**	**CREDITS**	**: 03**
CATEGORIES	**: MC**	**NO. OF HOURS/ WEEK**	**: 05**

Objectives:

- *To provide a broad conceptual approach that transcends all sections of anatomical and biochemical abnormalities.*
- *To understand molecular mechanisms in biological processes.*
- *To understand the medical, scientific and technological principles of clinical chemistry.*

UNIT: I

Chemistry of Nucleic acids: DNA Structure and function, RNA Types: Structure and function. Replication – Transcription – genetic code - Translation -Regulation of transcription and translation - Ageing – malignant transformation of cells and role of oncogenes. Apoptosis -cell regeneration.

UNIT: II

Molecular diagnostics: Recombinant DNA Technology, Polymerase chain reaction, application of PCR in diagnosis of pathogens - Site directed mutagenesis - DNA finger printing - DNA Foot Printing – antisense RNA technology - chromosomal walking – inherited genetic disorders in man and gene therapy

UNIT: III

Metabolic disorders and Diagnostic enzymology: Disorders of metabolism: carbohydrate – Lipids – Amino acids and Nucleic acids. Diagnostic enzymes: Role of Enzymes in Clinical Practice: Marker enzymes in myocardium, liver and pancreas. Tumour markers - Radio isotope techniques

UNIT: IV

Organ function tests: Liver function tests - Bile pigment metabolism - tests for liver function. Jaundice and its type –– Functions of Kidney, Urine formation and renal function tests disease of kidney - Renal Calculi : Theory of formation and analysis - Gastric Analysis - Composition of gastric juice, concepts of free and bound acid, Fractional Test Meal

UNIT: V

Hormones: Hypothalamus and pituitary hormones: Hormonal disturbances, Thyroid function –

Endocrine disorders. Non-protein nitrogenous compounds, Principles of Urea, Creatinine and Uric acid formation

TEXT BOOKS

1. Gaw, A., M.J. Murphy, R.A. Cowan, D.J. O'Reily, M.J. Stewart and J.Shepherd, 2008.Clinical Biochemistry, Elsevier,
2. Malacinki,G.M., 2005. Essentials of Molecular Biology, Jones and Barlett Publishers, New Delhi.

REFERENCE BOOKS

1. Chatterje, M.N. and R. Shinde, 2005. Textbook of Medical Biochemistry, Jaypee Brothers, New Delhi.

2. Davidson,S.S., J. MacLeod and C.R.W. Edwards,1991. Principles and Practice of Medicine, Churchill Livingstone, United kingdom.

3. Nelson, D.L. and M. M. Cox, 2008. Lehninger Principles of Biochemistry, WH Freeman and Company New York.

4. Twyman, R.M. 1999, Advanced molecular Biology, Bios Scientific, UK.

5. Voet, D., Voet, J.G. and C.W. Pratt, 2008. Fundamentals of Biochemistry, John Wiley and Sons, New Delhi

ML 1814 HAEMATOLOGY

SEMESTER	**: I**	**CREDITS**	**: 03**
CATEGORY	**: MC**	**NO. OF HOURS/ WEEK**	**: 05**

Objectives:

- *To study the components, characteristics, functions, and abnormalities and disease states of human blood.*
- *To identify principles and procedures of hematology tests including sources of error and clinical significance of results.*

Unit I:

Blood components, Blood functions, Plasma proteins, Hemoglobin –derivatives, synthesis, destruction, estimation techniques, red cell indices, red blood cells and hemoglobin- physiological variation, pathological variation, variation in the size, estimation of red cells, fragility of red cells

Unit II:

Haemopoietic system – erythropoiesis, thrombopoiesis and leucopoiesis. Anaemia – symptoms, diagnosis, classification, causes, treatment. Genetic disorders

Unit III : Hemostasis, Fibrinolysis, Blood clotting factors, mechanism of coagulation, tests of blood coagulation, bleeding disorders, Quality control and quality assessment, anticoagulants

Unit IV : Clotting time, Bleeding time, Haemoglobin estimation, Erythrocyte Sedimentation Rate, microhematocrit, macrohematocrit, red cell indices, Differential count, Total Red Blood cell count, Total White blood cell count, Platelet count, Eosinophilic count, Reticulocyte count

Unit V: Osmotic fragility, Heinz body preparation, Sickle cell preparation, Lupus erythematosus (LE) cell preparation, NESTROF.

TEXT BOOKS

1. Hoffbrand,A.V. and P.Moses, 2011.Essential Haematology, John Wiley and Sons, Chicester.
2. Mukerjee, K.L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume I, McGraw Hill, New Delhi.

REFERENCE BOOKS

1. Godkar, P.B. and D.B. Godkar, 2006. Medical Laboratory Technology, Bhalani, New Delhi.
2. Hoffman, R., E.J. Benz, S. J.Shattil, B. F. Harvey, J. Cohen, L. E. Silberstein and P. McGlave, 2005. Haematology-Basic principles and practice, Churchil livingstone, Philadelphia.
3. Manoharan, A. and S.Sethuraman, 2003. Essentials of Clinical haematology, Jaypee Brothers, New Delhi.
4. Richard, A., McPherson, M.R. Pincus, 2007. Clinical Diagnosis and management by Laboratory methods, Elsevier, New Delhi.
5. Sood, R., 2006. Medical Laboratory methods and Interpretation, Jaypee, New Delhi.

ML 1815 MOLECULAR BIOLOGY AND BIOCHEMISTRY LAB COURSE

SEMESTER	**: I**	**CREDITS**	**: 04**
CATEGORIES	**: MC**	**NO. OF HOURS/ WEEK**	**: 06**

Objective:

- *To impart skills to analyze various biochemical products in normal and abnormal conditions.*
- *To understand the applications of clinical biochemistry for the diagnosis and monitoring of human disease and its contribution to biomedical research.*

UNIT: I

Laboratory instruments- (Photometry, Centrifuge, Water bath). Medical laboratory professional - professionalism in biochemistry laboratory. Calibration of pipettes and other volumetric apparatus. General approach to specimen collection, transport and disposal. Anticoagulants

UNT: II

Estimation of blood sugar, Glucose tolerance tests(GTT), Glycosilated haemoglobin(HbA1C). Lipid determination of serum lipids – cholesterol, triglycerides and lipoprotein fractionation

UNIT: III

Liver function tests: Estimation of Total Protein, Albumin & A/G ratio, Estimation of Bilirubin – total and conjugated. Renal function test: Estimation of NPN substances a) Blood Urea, b) Serum Creatinine. c) Serum Uric acid

UNIT: IV

Enzymes: Determination of Alkaline Phosphates, Acid phosphates, S G O T, SGPT, salivary Amylase. Cardiac markers: Creatine phosphokinase, Lactate dehydrogenase(LDH). Inorganic ions – Determination of calcium in serum and urine, serum phosphates, chloride sodium and potassium

UNIT: V

Agarose gel electrophoresis – SDS-PAGE – Isolation of DNA from whole blood sample – restriction digestion of lambda DNA using Eco RI and Hind III – Restriction fragment length polymorphism – Isolation of RNA – Quantification of DNA by diphenyl method- PCR.

TEXT BOOKS

1. Fischbach, F.T. and M.B. Dunning, 2009. A Manual of laboratory and Diagnostic Tests, Lippincott Williams Wilkins, New York.
2. Sonnenwirth, A. C. and L. Jarret, 2000. Gradwohls' Clinical laboratory methods and diagnosis. M.D.B.I., New Delhi

REFERENCE BOOKS

1. De Roberties, E.D.P., and De Robertis, E.M.F., 1996. Cell and Molecular biology, B.I.Waverly Pvt.Ltd, Philadelphia
2. Mukerjee, K.L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume II, McGraw Hill, New Delhi.
3. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice, McGraw Hill, New Delhi.
4. Sood, R., 2006. Medical Laboratory methods and Interpretation, Jaypee, New Delhi.

ML 1816 - HAEMATOLOGY LAB COURSE

SEMESTER	**: I**	**CREDITS**	**: 4**
CATEGORY	**: MC**	**HOURS / WEEK**	**: 6**

Objectives:

- *To impart hands on training for identifying blood cell abnormalities for the diagnosis of disease.*
- *To provide skills necessary to perform blood cell count and evaluation of blood elements within stated limits of accuracy.*

Unit I

Microscope handling, collection of blood, Blood Pressure, Pulse rate, hemocytometer, cell counter

Unit II

Clotting time, Bleeding time, Haemoglobin estimation, Erythrocyte Sedimentation Rate, microhematocrit, macrohematocrit, red cell indices

Unit III

Differential count, Total Red Blood cell count, Total White blood cell count, Platelet count, Eosinophilic count, Reticulocyte count

Unit IV

Osmotic fragility, Heinz body preparation, Sickle cell preparation, Lupus erythematosus (LE) cell preparation, NESTROF

TEXT BOOKS

1. Godkar, P.B. and D.B. Godkar, 2006. Medical Laboratory Technology, Bhalani, New Delhi.
2. Mukerjee, K.L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume II, McGraw Hill, New Delhi.

REFERENCE BOOKS

1. Cheesbrough, M, 2006, Medical Laboratory Manual for Tropical Countries Vol. I and II, Cambridge University Press; UK
2. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice, McGraw Hill, New Delhi.
3. Sood, R., 2006. Medical Laboratory methods and Interpretation, Jaypee, New Delhi.

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ML 2814 – MEDICAL MICROBIOLOGY

SEMESTER: II **CREDITS : 5**

CATEGORY: MC **NO. OF HOURS / WEEK : 6**

Objectives:

- *To introduce basic principles of Microbiology.*
- *To impart theoretical knowledge of the etiological agents responsible for global infectious diseases and to impart knowledge of microbiology to be used in a variety of clinical settings to solve diagnostic problems.*

Unit I: Introduction

Definition and scope of Microbiology - History and recent developments - spontaneous generation - Biogenesis-contributions of Louis Pasteur - Leewenhoek, Lazaro Spallanzani, John Tyndall, Joseh Lister - Robert Koch. Microbial kingdoms - Five kingdoms - cell theory - Binomial nomenclature of microbes. Anatomy of prokayotes and eukaryotes - structure and function of cell wall, cilia, flagella, slime layer, capsule, pili, cytoplamic membrane and cytoplasmic inclusions, sporulation. Kingdom prokaryotes - classical techniques of microbial identification - morphological, physiological and biochemical properties

Unit II: Medical Bacteriology

Classification and general properties of medically important bacteria. Recommendation for collection, transport of specimens, isolation of bacteria from clinical specimens. Staphylococcus streptococcus Neisseria and Bordetella. Corynebacterium, Listeria, Mycobacetrium.Bacillus, Vibrios, Aeromonas, Campylobacter, Helicobacter, Pseudomonas, Brucella, Haemophilus, Enterobacteriaceae, Salmonella, Shigella, Proteus, Escherichia, Klebsiella, Clostridium, Mycoplasma, Rickettsiae, Spirochaetes, Treponema and Leptospira

Unit III: Medical Virology

General Properties of viruses - Detection of viruses and antigens in clinical specimens - Serological diagnosis of virus infections. Cultivation of viruses.Arthropod borne and rodent borne virus diseases - Picorna viruses and diseases. Hepatitis viruses: Rabies and other neuro viruses: Orthoinyxo and paramyxo viruses. Pox, Adeno, Herpes, Reo, Rota and HIV Virses, Oncogenic viruses, Viral vaccines, their Preparation and their immunisation schedules. Viruses of importance to bacteria - Bacteriophages - Their structure, types - Typing and application in bacterial genetics

Unit IV: Medical Mycology

Morphology, Taxonomy, clasification of fungi, detection and recovery of fungi from clincical specimens. Dermatophytes and agents of superficial mycoses. Trichophyton. Epidermophyton and Microsporurn. Yeasts of medical importance- Candida, cryptococcus. Mycotoxins, Dimorphic fungi causing systemic mycoses, Histoplasma, Coccidioides, Opportunistic fungi.Diagnosis of fungal infection. Immunity to fungal infections. Antifungal agents, testing methods and quality control

Unit V: Medical parasitology

Introduction to medical Parasitology - Classification, Protozoa - Entamoeba - Plasomodium, Leishmania - Trypanosoma -Giardia Trichomonas - Balantidium.Platyhelminthus -- Taenia - Fasciola - Paragonimus - Schistosorna. Nematihelminthes - Ascaris - Ankylostoma - Enterobius – Trichuris - Wuchereria - Dracunculus. Laboratory techniques in Parasitology. Examination of faeces for ova and cysts - Concentration methods. Blood smear examination for Parasites. Cultivation of Protozoan Parasites.

TEXT BOOKS

1. Chatterjee, K.D.,2009. Parasitology,CBS, Chennai.

2. Greenwood,D., R.C.B.Slack,J.F. Peutherer,M.R. Barer,2007. Medical Microbiology, Church Hill Livingstone,Philadelphia.

REFERENCE BOOKS

1. Alexopoulus, C.J and C. W. Mims, 1993. Introductory Mycology. Wiley Eastern Ltd, New Delhi.
2. Brooks, G.F., S. Morse, K.C. Carroll, J.Butel, 2010. Jawetz, Melnick, and Adelberg's Medical Microbiology, Mc Graw Hill, New Delhi.
3. Davis, B.D., R. Delbecco., H.N. Eisen and H.S. Ginsburg**,** 1990. Microbiology**,** Harper & Row, New**.** York
4. Dubey, R.C. and D.K. Maheswari, 2005. A text book of Microbiology, S.Chand, New Delhi.
5. Landecker, E.M.,1996. Fundamentals of the Fungi, Prentice Hall International, London.
6. Pelczar, M. J., E. C. S. Chan and N.R. Kreig, 2006. Microbiology, Tata McGraw Hill, New Delhi
7. Powar, C. B and H.F. Daginawala, 2005. General Microbiology, Vol.I & II, Himalaya Publishing House, Mumbai.
8. Salle, A.J., 2001. Fundamentals & Principles of Bacteriology. McGraw-Hill, New Delhi.

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ML 2815 IMMUNOLOGY

SEMESTER: II **CREDITS : 5**
CATEGORY: MC **NO. OF HOURS / WEEK: 6**

Objectives:

- *To understand the immune components, their organisation and measures to gain immunity against infections.*
- *To learn the genetically determined primary human immune deficiencies and selected human autoimmune diseases.*

Unit I: Immune components and their functions

General concepts of immune system, Innate and adaptive immunity; Inflammation-general properties. Structure, properties and functions of the immune cells & organs: T and B-lymphocytes, NK cells; Monocytes and macrophages; Neutrophils, eosinophils, and basophiles. Mast calls and dendritic cells, Thymus and Bone marrow; Lymph nodes, spleen, MALT, GALT and CALT

Unit II: Chemical aspects of immunology

Antigens - properties (foreignness, molecular size, heterogeneity). B and T cell epitopes. T-dependent and T- independent antigens. Haptens. Antibodies - Structure, function and properties of the antibodies; Different classes and biological activities of antibodies; Antibody as B cell receptor, antigenic determinants on antibodies (isotype, allotype and idiotype). Hybridoma technology, monoclonal antibodies. Organization of MHC. Structure and cellular distribution of HLA antigens. Components of the complement system, Biological consequence of complement activation and complement deficiencies,

Unit III: Applied Immunology

Hypersensitivity - immediate and delayed type hypersensitivity reactions. Forms of Immunity - nonspecific resistance, Tumor immunology .Immunological tolerance and immunosuppression. Immunotherapy of infectious diseases; Types and principles of immunization; vaccinoprophyl axis, vaccinotherapy, serotherapy. Types of grafts, immunologic basis of graft rejection, properties and types of rejection, tissue typing,

immunosuppressive therapy

Unit IV: Autoimmunity and Immunodeficiency disorders

Mechanisms of induction of organ specific (Hashimoto's thyroiditis, autoimmune anemias, Good pasture's syndrome, IDDM), and systemic (SLE, multiple sclerosis and rheumatoid arthritis) autoimmune diseases. Animal models of primary immunodeficiency (nude mouse and SCID mouse). Specific impaired functions in lymphoid lineage (SCID, Waldanstorm agamaglobulinemia, DiGeorge syndrome, common variable immunodeficiency), myeloid lineage (CGD, congenital neutropenia, Chediak-Higashi syndrome and leucocyte adhesion deficiency)

Unit V: Immunological principles of various reactions and techniques:

Affinity and avidity cross reactivity, precipitation, agglutination, immunodiffusion, immunoelectrophoresis, ELISA (indirect, sandwich, competitive, chemiluminescence, ELISPOT assay), western blotting, immunofluorescence, flow cytometry and fluorescence, and immunoelectron microscopy.

TEXT BOOKS

1. Owen,J., J.Punt, S.Stranford,2012.Kuby Immunology,WH Freeman, New York.

2. Paul, W.E.,2008. Fundamental Immunology,William and Wilkins, New York.

REFERENCE BOOKS

1. Coico,R, G. SunShine, 2009. Immunology : A Short Course, John Wiley and Sons, New York.
2. Delves,P.J., S.J.Dennis, R. Burton, I. M. Roitt, 2011. Roitt's Essential Immunology, John Wiley and Sons, New York.
3. Kindt,T.J., R.A.Goldsby, B. A. Osborne, J. Kuby and W.H.Freeman,2007. Immunology,
4. Peckman,M. and D.Vergain, 1997. Basic and Clinical Immunology, Churchill Livingstone,New York.
5. Playfair,J.H.L, 2001. Immunology at a Glance, Blackwell Scientific Publications, Oxford.
6. Stewart,S, 2001. Immunology, Immunopathology and Immunity, ASM Press Washington . W H Freeman and California.

ML 2816 - SEROLOGY AND BLOOD BANK LAB COURSE

SEMESTER	**: II**	**CREDITS**	**: 05**
CATEGORIES	**: MC**	**NO. OF HOURS/ WEEK**	**: 06**

Objectives:

- *To emphasize the basic principles of serology and competency in a clinical blood bank.*
- *To impart hands on training on immunological identification of infectious human diseases.*

Unit I:

Widal for Typhoid and RPR (Rapid Plasma Reagin)

Unit II:

Inflammatory Disorders, General inflammatory marks and specific therapeutic bioindicators. CRP (C reactive protein), RA (Rheumatoid Arthritis), ASO (Anti- Streptolysin O)

Unit III:

Immunological test for pregnancy, Haemagglutination, Compliment fixation, Precipitation and Immunodiffusion

Unit IV:

Basic principles involved in Immunohaematology as prior to blood transfusion, Blood collection procedure, Blood grouping (Slide method , tube method), Rh typing, Forward and Reverse grouping techniques, Cross matching(Major and Minor types), Separation of Blood components, Coombs test

Unit V:

HbsAg, HCV, HIV (ELISA, Western Blot tests), TPHA (Treponema pallidum haemagglutination), Malarial parasites.

TEXT BOOKS

1. Mukerjee, K.L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume II, McGraw Hill, New Delhi.
2. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice, McGraw Hill, New Delhi.
3. Sood, R., 2006. Medical Laboratory methods and Interpretation, Jaypee, New Delhi.

REFERENCE BOOKS

1. Henry, J.B., T. Sanford, and Davidson, 2002. Clinical diagnosis and Management by laboratory methods. Saunders, New York.
2. Richard, R,.,1989. Clinical Laboratory Medicine, Medical Publication, Chicago.
3. Sonnenwirth, A.C. and L. Jarret, 2000 Gradwohls' Clinical laboratory methods and diagnosis. M.D.B.I., New Delhi.

ML 2817 - MICROBIOLOGY LAB COURSE

SEMESTER: II **CREDITS : 5**

CATEGORY: MC **NO. OF HOURS / WEEK : 6**

OBJECTIVES:

- *To impart skills in essential microbiological techniques related to human samples.*
- *To demonstrate core concepts of microbiology, including the evolution and diversity of microbes; cell structure and function; metabolism; information flow and the role of microbes.*
- *To display proficiency in basic microbiological skills.*

Unit I:

Sterilization of glasswares, preparation of culture media, establishing pure cultures

Unit II:

Preparation of wet mount, motility test, Staining techniques – Simple, Gram's, Acid Fast, capsule

Unit III:

Physiological reaction of Bacteria – Catalase, coagulase, oxidase,urease, nitrate, carbohydrate fermentation, IMViC, TSI, esculin hydrolysis

Unit IV:

Identification of unknown organisms from skin, throat swab, urine and stool. Antibiotic sensitivity test

Unit V:

Examination of fungi-KOH method, saline wet mount, LPCB and Nigrosin staining, Germ tube test

TEXT BOOKS

Cappucino,J., N.Sherman, 2010. Microbiology a Laboratory Manual,Benjamin-Cummings,California.

REFERENCE BOOKS

1. Cheesebrough,M., 2006. Medical laboratory Manual for tropical Countries, Volume 1 & 2. Cambridge University Press, Cambridge,UK.
2. Collee,J.G., T.J.Mackie, J.E.McCartney, 1996. Practical Medical Microbiology, Churchill Livingstone, USA
3. Fischbach, F.T. and M.B. Dunning, 2009. A Manual of laboratory and Diagnostic Tests, Lippincott Williams Wilkins, New York.

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ML 2955 RESEARCH METHODOLOGY

SEMESTER : II	**CREDITS : 03**
CATEGORIE : MC	**NO. OF HOURS/ WEEK : 04**

Objectives:

- *To elaborate the importance of scientific research in laboratory techniques through systemic and experimental approach.*
- *To select and define appropriate research problem and parameters.*

UNIT I:

Research: Meaning – Purpose- Types of research-significance of research in social and health sciences - Steps in Research: Identification - selection and formulation of research problem – types and review of literature - Research design- Formulation of hypothesis – preparation of questioner

UNIT II:

Sampling Technique: Sampling theory-Types of sampling-Steps in sampling-Sampling and Non-sampling error-Sample size–Advantages and limitations of sampling. : Primary data: Meaning-Collection-methods-Observation–Interview-questionnaire-Schedule-Pretest-Pilot study –Experimental and case studies-Secondary data: Meaning – Relevance, limitations and cautions

UNIT III:

Processing Data: Checking- Editing-Coding- transcriptions and Tabulation- Data analysis- Meaning and methods- Quantitative and Qualitative analysis. Structuring the Report: Chapter format - Presenting footnotes – abbreviations- bibliography - Documentation-Use and format of appendices- Indexing - Contents-Styles of reporting- Steps in drafting reports-Editing the final draft-Evaluating the final draft. Thesis writing – preparation of manuscript for scientific publications – impact factors

UNIT IV:

Collection and representation of data- tabulation and diagrams – scatter diagram – histogram – bar diagram – frequency curve – frequency polygon – ogives – logarithmic curve – tridimentional graph – pie diagram

UNIT V:

Research Proposal**:** Contents-Preamble, the problem, objectives, hypothesis to be tested, study,

design, setup, measurement procedures, analysis of data, organization of report; Displaying data tables, graphs and charts – preparation of project proposal: Thrust area – funding agencies (National and International) – kinds of research program in India and abroad – career development in laboratory research – principle and method of patenting.

TEXT BOOKS

1. Gurumani, N., 2006. Research methodology for biological sciences, MJP, Chennai.
2. Kothari, C.R., 2006. Research Methodology (Methods and Techniques), New Age Publisher, New Delhi

REFERENCE BOOKS

1. Bausell,R.B., Yu-Fang Li, Power Analysis for Experimental Research a Practical Guide for the Biological, Medical and Social Sciences, Cambridge University Press, Cambridge.
2. Kuehl ,R.O., 2009. Design of Experiments: Statistical Principles of Research Design and Analysis, Belmont, California.
3. Wilcox,R.R.,2010. Fundamentals of Modern Statistical Methods, Springer, NewYork.

ML 2956 COMMUNITY MEDICINE

SEMESTER: II **CREDITS : 3**

CATEGORY: ES **NO. OF HOURS / WEEK : 4**

Objectives:

- *To recognize the importance of community medicine in the context of the health needs of the community and national priorities in the health sector.*
- *To be able to identify, prioritize and manage the health problems of the community after making community diagnosis*.

Unit I: Basic Epidemiology

Epidemiology: definition, concepts, uses and its role in health and disease. Use of basic epidemiological tools to make a community diagnosis of the health situation. Modes of transmission and measures for prevention and control of communicable and non-communicable diseases. Principal sources of epidemiological data. Definition, calculation and interpretation of morbidity and mortality indicators. Need, uses and evaluation of screening tests. Application of computers in epidemiology

Unit - II: Environment and health

Water: Concepts of safe and wholesome water, sanitary sources of water, waterborne diseases, water purification processes, water quality standards. Physical and chemical standards of drinking water quality and tests for assessing bacteriological quality of water. Concepts of water conservation and rainwater harvesting. Concepts of solid waste and human excreta and sewage disposal. Awareness of standards of housing and the effect of housing on health. Health hazards of air, water, noise, radiation pollution. Role of vectors in causing diseases. Identifying features of vectors and their control measures. Life cycles of vectors and advantages and limitations of various vector control measures. Mode of action, application cycle of commonly used insecticides and rodenticides

Unit - III: Genetics and community health

Basic principles of Genetics. Chromosomal Disorders. Genetic predisposition in Common disorder. Preventive and social measures - Eugenics & Euthenics, Genetic counseling . Early diagnosis, treatment and

rehabilitation. Occupational Health – Definition, Classification of Occupational Hazards and Diseases, Preventive measures for Occupational Diseases

Unit IV: Reproductive and child health

Current status of Reproductive and Child Health. Screening of high risk groups and common health problems. Reproductive child health (RCH) components, including child survival and safe motherhood, Universal Immunization Programme, Integrated Child Development Services Scheme (ICDS), Integrated Management of Neonatal and Childhood Illness (IMNCI) and other existing Programmes. Organization, implementation and evaluation of reproductive and child health program components. Various family planning methods, their advantages and shortcomings. Gender issues and Women empowerment Organizations, technical and operational aspects of the National Family Welfare Programme

Unit - V: Health Education

Approaches in health education. Methods of Health Education. Barriers to effective Communications. Principles of Health Education. International Health Organisations – WHO, UNICEF, Red Cross, Voluntary Health Organisation, International Health Regulations

TEXT BOOKS

1. Grobbe,D. and A.Hoes,2009.Clinical Epidemiology - Principles, Methods and Applications for Clinical Research,Jones and Barlett, New Delhi.

2. Hiremath, D.A., 2004. Essential of community medicine and practical approach, Jaypee, New Delhi.

REFERENCE BOOKS

1. Balaram,J.,2003.Community medicine: Preventive and social medicine, Jain, Chennai
2. Fletcher,R.H. and S. W. Fletcher, 2005. Clinical Epidemiology The Essentials, Williams and Wilkins, Philadelphia.
3. Wallace,R.B., 2008. Public health and Preventive Medicine, McGraw-hill, New Delhi.
4. Gupta, M.C. and B.K. Mahajan, 2003. Textbook of preventive and social medicine, Jaypee, New Delhi.
5. Dhaar, G.M.,and I. Robbanni, 2008. Foundations of Community Medicine, Elsevier,New Delhi.

ML 2301 CLINICAL TECHNOLOGY

SEMESTER	**: II**	**CREDIT**	**: 1**
CATEGORY	**:EG1**	**HOURS / WEEK**	**: 3**

Objectives:

- *To impart knowledge on medical lab technology to the students of non biology course.*
- *To enhance knowledge in laboratory safety, blood borne pathogens, and laboratory standards necessary to protect themselves and the patients.*

Unit I:

Selection, procurement and care of equipment, power supplies, microscope, centrifuges, autoclave, incubator, water bath, colorimeter, general laboratory ware

Unit II:

Common causes of accidents in lab, code of safe lab practice, safe lab premise, personal safety measures, decontamination of infectious material and disposal of lab waste, chemical and reagent hazards, equipment and glassware hazards, fire safety, emergency first aid

Unit III: Collection of blood, Blood Pressure, Pulse rate, Clotting time, Bleeding time, Haemoglobin estimation, Erythrocyte Sedimentation Rate, hematocrit

Unit IV:

Anemia, STD, diabetes, hypertension, bacterial infection, fungal infection, parasitic infection

Unit V:

Chromatography, PCR, stem cell therapy, clinical chemistry analysers, immulite automated immunoassay analyzer

TEXT BOOK

Godkar, P.B. and D.B. Godkar, 2006. Medical Laboratory Technology, Bhalani, New Delhi.

REFERENCE BOOKS

1. Mukerjee, K.L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume II, McGraw Hill, New Delhi.
2. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science: Theory and Practice, McGraw-Hill, New Delhi.
3. Sood, R., 2006. Text book of Medical Laboratory Technology, Jaypee, New Delhi.

ML 3811 FLUID ANALYSIS AND HUMAN DISORDERS

SEMESTER	**: III**	**CREDITS**	**: 5**
CATEGORY	**: MC**	**NO. OF HOURS / WEEK:**	**6**

Objectives:

- *To impart knowledge on the production, composition, normal and abnormal characteristics of body fluids and lab evaluation techniques*
- *To understand the pathological processes which occur due to abnormal fluids.*
- *To study the genetic and neurological disorders in human.*

Unit I: Physical properties of body fluids

Body fluid compartments, Solutes in body fluid, Clinical abnormalities of fluid volume regulation, Measurements of body fluid compartments, Movement of body fluids

Unit II: Amniotic and Cerebrospinal fluids

Formation and function of amniotic fluid, Chemical composition, Collection, Testing – Alpha foetoprotein, Acetyl cholinesterase, Neural tube defects, Haemolytic disease of newborn, Gestation age, Foetal maturation. Cerebrospinal fluid: Formation, Specimen collection, Causes of CSF pressure changes, Gross examination, Chemical analysis, Microbiological examination, Immunological tests, Cytological examination and clinical correlation

Unit III: Synovial fluid, Serous fluid and other body fluids

Classification of joint disorders, Non-inflammatory joint diseases: Osteoarthritis, Traumatic arthritis and Neurogenic joint disease.Inflammatory joint disease: Rheumatoid arthritis, Lupus arthritis,Cell count, Chemical and serological examinations, Clinical correlations. Serous fluid: Formation, Collection, Classes of effusions, Cell types and clinical correlations. Lymph, Gastric fluid, Urine, Faeces, Seminal fluid, Sputum and sweat

Unit IV: Genetic disorders

Colour blindness, Cri du chat syndrome, Cystic fibrosis, Down's syndrome, Duchenne muscular dystrophy, Haemochromatosis, Haemophilia, Klinefelter's syndrome, Turner syndrome, Polycystic kidney disease, Prader–Willi syndrome, Sickle-cell disease

Unit V: Neurological disorders and Vitamins deficiencies

Alzheimer's disease, autism, Canavan's disease, Parkinson's disease, Carpal tunnel syndrome, Lesch- Nyhan syndrome, Lyme disease, multiple sclerosis, Wallenberg's syndrome and Werdnig-Hoffman disease. Beriberi, Pellagra, Biotin Deficiency, Scurvy, Rickets, Arabiflavinosis, Vitamin K deficiency, Hypocobalaminemia, Paraesthesia and Night blindness.

TEXT BOOKS

1. Guyton, A.C. and J.E. Hall, 2010. Textbook of Medical Physiology, Elsevier, New Delhi.

2. Brunzel, N.A., 2013. Fundamentals of Urine and Body Fluid Analysis, Saunders, New Delhi.

REFERENCE BOOKS

1. Cella, J.H. and J. Watson, 2004. Manual of Laboratory Tests, AITBS Publishers, New Delhi.

2. Ellington, J.R. and T.S. Danowski, 2002. The Body Fluids, Williams and Wilkins, Baltimore.

3. Porth, C.M., 2011. Essentials of Pathophysiology. Concepts of Altered Health States, Williams and Wilkins, Baltimore.

4. Strasinger, S.K. and M.S. Di Lorenzo, 2008. Urinalysis and Body Fluids, F.A. Davis, Philadelphia.

5. Tortora, G.J. and B.H. Derrickson, 2011. Principles of Anatomy and Physiology, Harper Collins, New York.

ML 3812 URINE ANALYSIS AND STOOL EXAMINATION - LAB COURSE

SEMESTER : III **CREDITS : 5**

CATEGORY : MC **NO. OF HOURS / WEEK: 7**

Objectives:

- *To provide hands on training in laboratory techniques to diagnose the abnormal characteristics of urine and stool.*
- *To correlate laboratory results with the probable pathological conditions.*

Unit I: Urine analysis (Physical)

Composition, collection and preservation of urine for various tests f urine, Types of preservative, Physical examination: Volume, colour, odour, appearance, specific gravity and pH

Unit II: Urine analysis (Chemical)

Reducing sugar-Benedict test, protein -Heat and acetic acid test, and sulfosalicylic acid method, Ketone bodies-Rothera's test, Bile pigment (Fouchet method), bile salt (Hay's test), Urobilinogen- Ehrlich aldehyde test and Bence Jones protein test, Renal clearance test-urea, creatine, Test for mucin. Test for Drugs of Abuse - Methadone, metha - Amphetamine, Benzodiazepine, Cocaine, Morphine, Cannabinoids and Phenobarbitone

Unit III: Urine analysis (Microscopic)

Microscopic examination; Identification of casts and crystals and blood cells-RBC, WBC, smear for gram staining and urine culture

Unit IV: Stool Examination

Collection of fecal specimen, preservation, physical examination; volume, colour, odour and appearance. Identification of crystals, meat fibers, fat globules and blood cells. Chemical examination; reducing sugar, occult blood test, Demonstration of fat in stool, detection of steatorrhoea

Unit V: Techniques for Intestinal Parasites

Identification of Parasites in wet mounts,Concentration methods, direct centrifuge floatation method and ether extraction method for ova and cysts. Culture especially for enriched group of organisms.

TEXT BOOKS

1. Mukerjee, K.L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume II, McGraw Hill, New Delhi.

2. Sood, R., 2006. Medical Laboratory methods and Interpretation, Jaypee, New Delhi.

REFERENCE BOOKS

1. Fischbach, F.T. and M. B. Dunning, 2009. A Manual of laboratory and Diagnostic Tests, Lippincott Williams and Wilkins, NewYork.
2. Godkar, P.B. and D.B. Godkar, 2006. Medical Laboratory Technology, Bhalani, New Delhi.
3. Henry, J.B., 2001. Clinical Diagnosis and Management by Laboratory Methods, W.B.Saunders, Pennsylvania.
4. Mundt, L.A., and K.S. Shanahan, 2011. Textbook of Urinalysis and Body Fluids, Williams and Wilkins, NewYork.
5. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice, McGraw Hill, New Delhi.

ML 3813 SEMINAL AND SPUTUM ANALYSIS - LAB COURSE

SEMESTER	**: III**	**CREDITS**	**: 5**
CATEGORY	**: MC**	**NO. OF HOURS / WEEK**	**: 7**

Objectives:

- *To impart hands on training on the techniques for analysis of sputum and seminal fluid.*
- *To correlate laboratory results with the probable pathological conditions.*

SEMINAL FLUID EXAMINATION

Unit I: Macroscopic examination

Sample collection and handling techniques. Physical examination- Volume, Appearance, color, odor, pH, viscosity. Fructose estimation

Unit II: Microscopic Examination: Sperm count, Sperm morphology, sperm count, Sperm motility test, Sperm vitality test, Mixed antiglobulin Reaction test and Immunobead test- Direct and Indirect method

Unit III: Staining Methods: Eosin staining, Giemsa staining, Carbol fuchsin and Methylene blue staining, Basic fuchsin staining Papanicalou staining, Schorr staining, Cellular peroxidase staining using ortho – toluidine

SPUTUM EXAMINATION

Unit IV: Collection and disposing sputum, Physical examination; Identification of Eosinophils- wet mount method, Eosin method, Identification of *Aspergillus*-Potassium Hydroxide metho

Unit V: Gram staining of sputum, AFB staining of sputum, concentration techniques, culture techniques.

TEXT BOOKS

1. Mukerjee, K.L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume II, McGraw Hill, New Delhi.

2. Sood, R., 2006. Medical Laboratory methods and interpretation, Jaypee, New Delhi.

REFERENCE BOOKS

1. Godkar, P.B. and B.Godkar, 2003. Medical Laboratory Technology, Bhalani Book Depot, New Delhi.

2. Marks, V., T.Cantor, D.Mesko, R.Pullman and G. Nosalova, 2003. Differential Diagnosis in Lab Medicine, Springer, India.

3. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science, Theory and Practice, McGraw Hill, New Delhi.

4. WHO laboratory manual for the processing of human semen, 2010, Geneva.

ML 3953 HOSPITAL MANAGEMENT

SEMESTER	**:**	**III**	**CREDITS**	**:**	**3**
CATEGORY	**:**	**ES**	**NO. OF HOURS/ WEEK**	**:**	**4**

Objectives:

- *To provide basic knowledge on Health Care and administration of Clinical and Non-Clinical Services.*
- *To understand and apply resource management concepts (personnel, finance, and material resources) and the processes and strategies needed in specific hospital sectors.*
- *To analyse existing hospital service policies and enhance their alignment within the local and national context.*

Unit I: Principles and Practices of Management

Basic concepts of Management: Definition, functions of management, Planning, organizing, directing, controlling and coordinating and decision making. Organizational behavior - personality and attitudes, motivation, formation of teams and team work

Unit II: Human Resource Management

Functions of Human Resource Management, the Managerial Perspective. Human Resource Development (HRD). Manpower Planning and Development: Job Analysis, Job Description and Specifications ,Selection and recruitment, orientation.Manpower Developing andTraining, Career Planning, Promotion Policies. Wage and Salary Administration, Employee Benefits and Social Security, Performance Appraisals. Issues Relating to Management of Professionals, Consultants, Specialists, Medical Officers, Nursing Staff, Other Paramedical Staff

Unit III: Material Management

Principles of Materials Management:Definition, Scope and Functions, Objectives. Materials Planning - Classification of Materials: Consumables, Non consumables, Budgeting. Purchase Management: Objectives, Purchase system, Purchase Procedures, Selection of Suppliers and Store management

Unit IV: Inventory Control

Aims and objectives, Scope of Inventory Control, Tools and Techniques of Inventory control. Classification of inventory, Techniques of inventory Control. Computerization of inventory transactions, Sub-stores in various departments, Physical stock taking. Medical Stores – Functions, Storage condition/Monitoring, Expiry dates and action, Role of drug Review Committee

Unit V: Health Care and Administration of Clinical and Non-clinical Services

National Health Policy, National Health Programmes, Hospital Accreditation, Role of Quality Council of India (QCI), National Accreditation Board of Hospitals (NABH). Clinical and non – clinical services: Radiology Services, Pathology and Clinical Laboratory, Central Sterile Supply Department, Laundry and Linen Services, House Keeping Services, Disposal of Biomedical Waste, Medical Records Department, Maintenance of Building, Campus and Utilities and Fire safety.

TEXT BOOKS

1. Malhotra, A.K., 2009. Hospital management: An Evaluation, Global India, New Delhi.

2. Sakharkar, B.M., 2009. Principles of Hospital Administration and Planning, Jaypee, New Delhi.

REFERENCE BOOKS

1. Aswathappa, K., 1998. Human Resource and Personnel Management, Tata McGraw Hill, New Delhi.
2. Das, G.J., 2009. Hospital Administration and Management A Comprehensive Guide, Jaypee, NewDelhi.
3. Dessler, G., 2002. Human Resource Management – Prentice Hall, India.
4. Parthasarathi, S.K., 2003. Hospital Services Management. K.J. Hospital, Chennai.
5. Sharma, M., 2000. Essential of Hospital Support Services and Physical Infrastructure. Jaypee , New Delhi.

ML 3954 FORENSIC SCIENCE AND TOXICOLOGY

SEMESTER: III	**CREDITS**	**:**	**3**
CATEGORY: ES	**NO. OF HOURS / WEEK**	**:**	**4**

Objectives:

- *To understand the challenges, methods and analyses of forensic and toxicology samples.*
- *To study the effect of drugs and poisons on human.*
- *To understand the basic principles of DNA profiling*

Unit I: Forensic Pharmacology

Pharmacology and its branches, Forensic Pharmacological studies, absorption, distribution, pharmokinetic, metabolic pathways of common drugs and poisons, Drug toxicity, excretion of drugs and poisons, method of extraction, isolation, identification of metabolites. Metabolites of methanol and ethanol, acetyl salicylate, DDT, Parathion, carbaryl, pheno barbitone, diazepam, amphetamine and heroin motobolite identification by GC-Mass and LC-Mass

Unit II: Forensic Toxicology

Introduction and scope of forensic toxicology. Different types of poisons commonly encountered. Different routes of ingestion, toxicity of poisons. Fate of drug in body. Samples in fatal and non- fatal cases. Packing and preservations of viscera. Extraction and screening of common poisons and methods of analysis of poisons. Forensic toxicology of Ethyl alcohol. Determination of alcohol in field by breath analyser

Unit – III: Radioactive isotopes and compounds

Introduction: Nuclear energy and radioactive sources of exposure and contact, acute and chronic effect on the organs of the body methods of detection and measurements handling and disposal of body and tissues containing radioactive material. Medico-legal interpretation

UNIT IV: DNA Profiling

Introduction, History of DNA Typing, human genetics- heredity, alleles, mutations and population genetics, molecular biology of DNA, variations, polymorphism, DNA typing systems- RFLP analysis, PCR amplifications, sequence polymorphism. Analysis of SNP, Y- STR. Mitochondrial DNA, evaluation of results, frequency estimate calculations, interpretations, allele frequency determination, match probability- database, quality control, certification and accreditation

UNIT V: Forensic Significance of DNA profiling:

Applications in disputed paternity cases, child swapping, missing person's identity- civil immigration, veterinary, wildlife and agriculture cases, The Combined DNA Index System (CODIS), legal perspectives- legal standards for admissibility of DNA profiling, procedural and ethical concerns, status of development of DNA profiling in India and abroad.New and future technologies: DNA chips, SNPs and limitations of DNA profiling.

TEXT BOOKS

1. Sharma, R.K., 2005. Concise text book of forensic medicine and toxicology, Elsevier, New Delhi.
2. Vij, K., 2001.Textbook of Forensic Medicine, Churchill Livingstone, New Delhi.

REFERENCE BOOKS

1. Basu. R., 2004. Fundamentals of Forensic Medicine and Toxicology, Books and Allied, Kolkata.
2. Butler, J. M., 2005. Forensic DNA Typing: Biology, Technology and Genetics of STR Markers, Academic Press, New York.
3. Niesink, R.J.M., 1996. Toxicology - Principle and Application, CRC Press, New York.
4. Norah, R., 2002. An Introduction to Forensic DNA Analysis, CRC Lewis, New York.
5. Paul, T., 1998. Recent Advances in Pharmacology and Toxicology, Churchill Living Stone, London.
6. Sethi, P.D., 2005. Quantitative Analysis of Drugs in Pharmaceutical Formulations, CBS, New Delhi.

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ML 3876 MODERN CLINICAL PRACTICES AND ETHICS

SEMESTER: III **CREDITS : 5**

CATEGORY: ID **NO.OFHOURS / WEEK: 6**

Objectives:

- *To understand the challenges and methods of modern clinical practices and contemporary ethical issues.*
- *To recognize different approaches in ethical decision making.*

Unit I: Accreditation and Lab safety

Laboratory requirements for quality and competence- International Perspective. Preparing a Quality Manual (Structure and Format) – NABL 160. ISO 15189: 2007.Chemical hazards, Biological hazards- Biological agents and toxins, Physical hazards - Ergonomic hazards, Radiation Hazards

Unit II: Cloning and Ethical implications:

Reproductive cloning , therapeutic cloning ; Ethical, legal and socio-economic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research- GM crops and GMO's – biotechnology and biopiracy – ELSI of human genome project

Unit III: Reproduction and Bioethics

Maturation and fertilization of ovum, function of the placenta, hormonal control in pregnancy and parturition. Adjustment of the infant to extra uterine life, special functional problems in the neonate, the role of fetal factors in programming adult- onset of diseases. Personhood – Abortion – Bioethical issues in reproduction, population explosion and control – Assisted reproduction – Egg donation – Prenatal screening and sex selection – Cloning- Ethical issues on life & death – Brain Vs Cortical death – Persistent vegetative state – Voluntary euthanasia and physician assisted suicide

Unit IV: Human genome and therapy

Ethical issues on New Genetics – Human Genome Project. Experimentation with human subjects - National Practice of health care – Public and Private medical practice – National resource allocations

Unit V: Contemporary ethical issues and human experiment

Ethical issues in research on human subjects – organ Transplantation - justification of transplantation - Patient selection – organ donation. Guidelines for preparing Standard Operating Procedures (SOP) for Institutional Ethics Committee for Human Research.

TEXT BOOKS

1. Basterra, E. and F. Javier., 1989. Bioethics, Liturgical Press Collegeville, United States.
2. Hope, R.A., 2004. Medical Ethics: A Very Short Introduction, Oxford University Press, New Delhi.

REFERENCE BOOKS

1. Braunwald, E., A.S. Fauci, D.L.Kasper, S.L.Hauser, and D.L. Longo, 2001. Principles of Internal medicine, Volume 1, McGraw Hill, New Delhi.
2. Gile, T.J., 2010. Complete Guide to Laboratory Safety, HC Pro Inc., United States.
3. Hall, J. E. and A.C. Guyton, 1996. A text book of Medical physiology, Saunders, New York.
4. Rose, S., 1984. Clinical Laboratory Safety, Lippincott. Philadelphia.
5. Kumar,V., S. R. Cotran and S.L.Robbins, 2012. Basic pathology, Saunders, New York.

ML 3301 CLINICAL TECHNIQUES

Semester : III **Credits : 01**

Category : EG 1 **Hours/week : 03**

Objectives:

- *To impart knowledge on medical lab technology to the students of non biology course.*
- *To provide students with adequate knowledge on clinical laboratory services.*

Unit I: Selection, procurement and care of equipment, power supplies, microscope, centrifuges, autoclave, incubator, water bath, colorimeter, general laboratory ware

Unit II : Common causes of accidents in lab, code of safe lab practices, safe lab premises, persona safety measures, decontamination of infectious material and disposal of lab waste, chemical and reagent hazards, equipment and glassware hazards, fire safety, emergency first aid

Unit III: Collection of blood, blood pressure, pulse rate, clotting time, bleeding time, hemoglobin estimation, erythrocyte sedimentation rate, hematocrit

Unit IV: Anaemia, STD, diabetes, hypertenision, bacterial infection, fungal infection, parasitic infection

Unit V: Chromatography, PCR, stem cell therapy, clinical chemistry analysers, automated immunoassay analyzer.

TEXT BOOKS

1. Estridge, B.K. and A.P. Reynolds, 2012. Basic Clinical Laboratory Techniques, Clifton Park, New York.

2. Mukerjee, K.L. and S. Ghosh, 2010. Medical Laboratory Technology, Volume I and II, McGraw Hill, New Delhi.

REFERENCE BOOKS

1. Godkar, P.B. and B. Godkar, 2006. Textbook of Medical Laboratory Technology, Bhalani, Mumbai.
2. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science: Theory and Practice, McGraw Hill , New Delhi.

3. Rajan, S., 2012. Medical Laboratory Technology, Anjanaa, Chennai.

4. Ramakrishnan, S. and K.N. Sulochana, 2012. Manual of Medical Laboratory Techniques, Jaypee, NewDelhi.
5. Sood, R., 2006. Text book of Medical Laboratory Technology, Jaypee, New Delhi.

ML 4814 NON INVASIVE TECHNIQUES

SEMESTER	**: IV**	**CREDITS**	**:**	**5**
CATEGORY	**: MC**	**NO. OF HOURS / WEEK**	**:**	**5**

Objectives

- *To introduce the concept of physiology and the electrical components of a biomedical techniques.*
- *To discuss the measurement of physiological parameters.*
- *To understand the concepts of imaging system and telemetry, and various therapeutic equipments used in medicine.*

Unit I: Basic concepts of medical imaging

Biopotential electrodes- Basic medical instrumentation system- Radiation- X-Ray -Fundamentals of X-ray, Generation and Detection of X-rays, X-ray Diagnostic Methods- Dual energy X ray Absorptiometry, Electroencephalography, Recording- Electrocardiography- Stress testing- tread mill test- Electromyography and nerve conduction studies

Unit II: Nuclear medical imaging

Fundamentals of radioactivity, Computed Tomography: Basic principles, diagnostic methods- Positron Emission Tomography - Single Photon Emission Computed Tomography

Unit III:

Fundamentals of Nuclear Magnetic Resonance, Imaging Methods, Magnetic Resonance imaging- Ultrasonography- Fundamentals of Acoustic Propagation, Ultrasonic Diagnostic Methods- Transcranial doppler studies

Unit IV: Ophthalmological examination

Visual acuity test- Fluorescein angiography- Opthalmoscopy- Electroretinography, Oculoplethysmography- Oculopneumoplethysmography- Evoked potential studies

Unit V:

Mammography- conventional mammography, digital mammography- virtual and conventional colonoscopy- angiography- coronary angiography, microangiography- fluoroscopy and Thermography.

TEXT BOOKS

1. Chatterjee, S. and A. Miller, 2010. Biomedical Instrumentation Systems, Clifton Park, New York.

2. Khandpur, R.S., 2005. Handbook of Biomedical Instrumentation, McGraw Hill, New Delhi.

REFERENCE BOOKS

1. Arumugam, M., 2003. Biomedical Instrumentation, Sapna, Chennai.
2. Geddes, L.A. and L.E. Baker, 1989. Principles of Applied Bio-Medical Instrumentation, John Wiley and Sons, New York.
3. Grossman, D.G., 2003. The Clinical Guide to Diagnostic Imaging, Raven Press, New York.
4. Malarkey, L.M. and M. Ellen, 2000. McMorrow Nurse's manual of laboratory tests and diagnostic procedures, Saunders, Canada.
5. Sharma, B.K., 2001. Instrumental Methods of Chemical Analysis, Goel, Meerut.
6. Webster, J.G., 2004. Medical Instrumentation-application and design, John Wiley and sons, New York.

ML 4815 SEPARATION TECHNIQUES AND PHARMACEUTICAL CHEMISTRY

SEMESTER : IV **CREDITS : 5**

CATEGORY : MC **NO. OF HOURS/ WEEK : 6**

Objectives:

- *To impart basic knowledge on techniques for analytical separation processes and drug metabolism.*
- *To elaborate basics of scientific investigation applied in chemical, biological and pharmaceutical sectors.*

Unit I: Principles of separation and Centrifugation techniques

Principles and fundamentals of different separation techniques, significance of various separation techniques and their applications. Basic principles, procedure and working mechanism – Different methods of centrifugation techniques (Differential, density gradient – Zonal and isopyenic and ultra centrifugation)

Unit II: Chromatographic techniques

Introduction to chromatographic methods, Principles, instrumentation and working mechanism: Chromatographic techniques: paper, thin layer and column chromatography, Gel, Ion and affinity chromatography, Instrumentation of GC and HPLC, applications in qualitative and quantitative analysis, comparison of GC and HPLC

Unit III: Electrophoresis and Molecular techniques

Theory of electrophoresis, types of electrophoresis: moving boundary and zone electrophoresis, paper and polyacrylamide gel electrophoresis. SDS-PAGE- and their applications. Isolation of DNA and RNA - Agarose gel electrophoresis and its applications. Blotting techniques (Southern, Northern and Western), PCR techniques and their applications

Unit IV: Principles of Pharmacology and Pharmacokinetics

Physicochemical factors in transfer of drugs across membranes, Drug absorption, bioavailability and routes of administration, Distribution of drugs. Excretion of drugs, Metabolism of drugs Clinical pharmacokinetics, Clearance-distribution, Half-life, Therapeutic drug monitoring

Unit V: Pharmacodynamics

Mechanism of drug action, Drug receptors, Receptors for physiological regulatory molecules, Physiological receptors: Structural and functional families, Regulation of receptors, Quantitation of drug-receptor interactions and effects.

TEXT BOOKS

1. Brunton, L.L., J.S. Lazo and K.L. Parker, 2006. The Pharmacological Basis of Therapeutics, McGraw Hill, New Delhi.
2. Freifelder, D., 2004. Molecular Biology, Narosa Publishing House, New Delhi.

REFERENCE BOOKS

1. Burger, A. and R. Willey, 1970. Medicinal chemistry Volume I & II. CRC Press, New York.
2. Tripathi, K.D., 1998. Essentials of medicinal Pharmacology, Jaypee, New Delhi.
3. Satoskar, R.S. and S.C. Bhandarkar, 1978. Pharmacology and Pharmacotherapeutics, Vol. I & II, Popular Prakashan, Mumbai.
4. Wilson, K. and J. Walker, 2004. Practical Biochemistry - Principles and Techniques, Cambridge University Press, United Kingdom.

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ML 4816 HISTOPATHOLOGY AND MODERN DIAGNOSTICS

SEMESTER	**:**	**IV**	**CREDIT**	**:**	**4**
CATEGORY	**:**	**MC**	**NO OF HOURS**	**:**	**5**

Objectives:

- *To study pathologically altered structure and function of diseased cells, tissues and organs*
- *To understand the importance of tissue as a key resource for investigation and to evaluate the efficacy of future treatment modalities.*

Unit I: Introduction to histopathology

Definition, Morphology and physiology of cell, laboratory management and planning, sources and types histological specimens, kinds of histological presentations. Recording and labeling, fixation, properties of fixing fluids, classification and composition of fixing fluids. Advantages and disadvantages of secondary fixatives

Unit II: Tissue processing

Processing of histological tissues, Tissue Processor - dehydration and cleaning. Embedding - Water soluble substances, embedding in paraffin nitrocellulose. Technique of processing bone for histological studies. Mounting - Techniques, various mountings. Decalcification of calcified tissue

Unit III: Section Cutting

Equipment for sectioning: Microtome, knife, honing and stropping. Types, care and use of microtome. Techniques and principles of sections cutting – Frozen Section Techniques: Carbon Dioxide Freezing, Cryostat and freezing microtome. Technique for sectioning – Paraffin embedded tissue, Errors in sectioning and remedies. Attaching blocks to carriers

Unit IV Slide preparation & Staining

Preparation of slide, deparaffinization, Staining – theory, types of staining agent. Automatic slide stainer, Instruments for grossing, electric saw, Microphotography – technique. Mordents and differentiation. Hematoxillin and Eosin staining. Types of hematoxillin and its preparation. Eosin stock stain and other counter stains used

Unit V: Cytology

Cytology – introduction, definition, types of cytological specimen, preparation of slide for microscopic studies, stains used. FNAC, definition, techniques involved in preparation of smear and staining. PAP smear. Preparation of cell blocks, mailing of slides.

TEXT BOOKS

1. Mills, S.E., 2012. Histology for Pathologist, Williams and Wilkins, NewYork.

2. Mohan, H., 2010. Textbook of Pathology, Jaypee, New Delhi.

REFERENCE BOOKS

4. Godkar, P.B. and D.B. Godkar, 2006. Medical Laboratory Technology, Bhalani, New Delhi.
5. Ochei, J. and A. Kolhatkar, 2000. Medical Laboratory Science: Theory and Practice, McGraw-Hill, New Delhi.
6. Ross, M.H. and W. Pawlina, 2010.Histology: A Text and Atlas. Williams and Wilkins, NewYork.
7. Sarada, S. and M. Kutty, 1995. Textbook of Physiology, Orient Blackswan, Hyderabad.

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ML 4301 LIFE STYLE DISORDERS

SEMESTER: IV **CREDITS : 01**

CATEGORY: EG **NO.OF HOURS / WEEK: 03**

Objective:

- *To realize the importance of healthy lifestyle based on concepts of physical fitness, health and wellbeing.*
- *To understand as to how economic, cultural and social conditions serve as determinants of health.*
- *To enhance knowledge on need for coordinated services, and proper treatment - at the right place and right time, efficient use of resources, and self-management education.*

Unit I: Health and Nutrition

Understanding Concept of Food and Nutrition, Balanced Diet, Vitamins – Adolescent Nutrition- Anaemia, Obesity, Eating Disorders, Malnutrition – Deficiency Diseases, Determining Caloric Intake and Expenditure

Unit II: Health Concepts of Physical Education

Health - Definition and Meaning, Modern concept of Health, Physical fitness and Wellness, Dimension and Determinants of Health, Physical Activity and Health Benefits

Unit III: Lifestyle and Mental Health

Stress and Mood disorders, Anxiety disorders, Disruptive Behavior, Psychosis and related disorders, Substance abuse – smoking and alcoholism and other high risk behaviours

Unit IV: Lifestyle Diseases

Diabetes mellitus, Cardiovascular Problems- Systemic Hypertension and Arteriosclerosis, Neurological Disorders- Epilepsy, Headache, Sleep Disorders Alzheimer's Disease, Cancer, Chronic Liver Disease/Cirrhosis, Nephritis and Stroke

Unit V: Management of lifestyle diseases

Life Skill Education, stress management, Counseling and behavior therapy. Health related Physical Fitness and Assessment - Body mass Index/Skin folds Measurement, BMR, Pulse Rate, Blood Pressure, and Health Related Physical Fitness Test.

TEXT BOOK

Puri, K. and S.S. Chandra, 2005. Health and Physical Education, Surjeet, New Delhi.

REFERENCE BOOKS

1. Rai, B.C., 1979. Health Education and Hygiene, Prakashan Kendra, Lucknow.
2. Sommers, M.S., 2012. Diseases and Disorders, F.A. Davis and Company, Pennysylvania.
3. ACSM"s "Health Related Physical Fitness Assessment Manual, 2005, Lippincott Williams and Wilkins, NewYork.