



**ROYAL SCHOOL OF MEDICAL AND ALLIED SCIENCES
(RSMAS)**

DEPARTMENT OF MEDICAL LABORATORY TECHNOLOGY(MLT)

**Guidelines for framing
Curriculum and Credit Framework for
Postgraduate Programme in MLT
Specialization in
Medical Microbiology
And
Hematology and Blood banking**

**W.E.F
AY - 2025- 26**

(Based on National Education Policy 2020)

Year	Semester	Course Code	Component	Level	Credits	L-T-P	
1 ST YEAR	1 st Semester	Theory and Practical					
		MLT244C101/ MLT244C111	Clinical Pathology (Theory +Lab)	400	4	2-0-4	
		MLT244C102/ MLT244C112	Biochemistry I (Theory + lab)	400	4	2-0-4	
		MLT244C103/ MLT244C113	Immunology and Serology (Theory+Lab)	400	4	2-0-4	
		MLT244C104/ MLT144C114	Histopathology and Cytopathology (Theory +Lab)	400	4	2-0-4	
		MLT244C105	Advanced Diagnostic Techniques	400	4	3-1-0	
		MLT244C106	Biostatistics and Research Methodologies	400	4	3-1-0	
		Swayam Course		400	4		
	TOTAL CREDITS					28	
	2 nd Semester	Theory and Practical					
		MLT244C201/ MLT244C211	Medical Bacteriology and Mycology (Theory +Lab)/	500	4	2-0-4	
		MLT244C202/ MLT244C212	Haematology and Blood Banking (Theory + Lab)	500	4	2-0-4	
		MLT244C203/ MLT244C213	Biochemistry- II (Theory + Lab)	500	4	2-0-4	
		MLT244C204/ MLT244C214	Diagnostic Molecular Biology (Theory + Lab)	500	4	2-0-4	
		MLT244C205	Medical Lab Management	500	4	3-1-0	

		Swayam Course		500	4	
	TOTAL CREDITS				24	
<i>Students who exit at the end of 1st year shall be awarded a Postgraduate Diploma</i>						

Specialisation in Medical Microbiology

		Theory and Practical				
		Subject Code	Name of subjects	Level	Credit	L-T-P
2nd Year	3rd Semester	MLT244C30M1/ MLT244C31M2	Medical Parasitology (Theory+Lab)	500	4	2-0-4
		MLT244C30M3/ MLT244C31M4	Medical Virology (Theory+Lab)	500	4	2-0-4
		MLT244C303	Bioethics, IPR, Biosafety	500	4	3-1-0
		MLT244C304	Cytogenetics and molecular genetics	500	4	3-1-0
		MLT244C321	Minor Project	500	8	
	TOTAL CREDIT				24	
	Specialization in Hematology and Blood banking					
	3rd Semester	MLT244C30H1/ MLT244C31H2	Immunohematology (Theory+Lab)	500	4	2-0-4
		MLT244C30H3/ MLT244C31H4	Transfusion medicine and Coagulation (Theory+Lab)	500	4	2-0-4
		MLT244C303	Bioethics, IPR, Biosafety	500	4	3-1-0
MLT244C304		Cytogenetics and molecular genetics	500	4	3-1-0	
MLT244C321		Minor Project	500	8		
TOTAL CREDITS				24		
4th Semester	Research/Dissertation		Level	Credit	L-T-P	
	MLT244C421	Project/Dissertation	500	12		
	MLT244C422	Clinical Posting in Medical Microbiology/Hematology and Blood banking	500	8		
TOTAL CREDITS				20		
TOTAL CREDIT FOR THE COURSE = 96						

Level: Semester I

Level: 400

Title of the Paper: Clinical Pathology (Theory+ Lab)

Subject Code: MLT244C101/ MLT244C111

L-T-P-C: 2-0-4-4 (T+ P)

Total credits: 4

Course Objectives: The course is designed with an objective to give the students basic knowledge on the different types of biological specimen, different methods to collect them and the abnormal conditions related to it.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To recall about the different types of biological specimens commonly tested in clinical laboratory and the procedure to collect and analyze it.	BT 1
CO 2	To explain the clinical importance of 24 hours urine examination.	BT 2
CO 3	To apply the knowledge on sputum examination and other body fluids.	BT 3
CO 4	To analyze the physical and microscopic examination of the various biological specimen.	BT 4

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Collection, transport, preservation and processing of various clinical specimens such as blood, urine, stool, CSF, Semen and other body fluids and their safe disposal. Physical, chemical and microscopic examination of the pathological specimens.	9
II	Sputum examination: collection of specimen-Physical examination, Microscopic- Gram's stain, Zeihl-Neelsen stain for AFB, Chemical examination. Stool Examination- Collection, transport and preservation. Concentration and flotation method of examination of stool. Physical, microscopic and chemical examination.	9
III	Analysis of Body fluids: Pleural, Pericardial, synovial, ascitic/peritoneal, Semen and CSF fluid (physical, biochemical and microscopic examination). Other body fluids analysis- saliva, tears, sweat etc.	9
IV	Gastric analysis, Indications, contraindications. Method of collection, Fasting gastric juice, Macroscopic and microscopic examination, Fractional test meal, Augmented Histamine Test, Hollander's test. Pregnancy test, Method interpretation.	9
TOTAL		36

Text Books:

1. Textbook of Medical Lab Technology- Praful B Godkar, Darshan P. Godkar
2. Medical laboratory Technology Methods and Interpretation-Ramniksood.
3. Parasitology-K.D. Chatterjee.
4. Medical Laboratory Technology by Sood 5th Edition, Jaypee Brothers.

Reference Book:

1. Clinical Diagnosis & Management -Todd & Sanford 19th edition 1996.
2. Lynch's Medical lab-Technology Latest edition.

Title of the Paper: Clinical Pathology Lab

L-T-P-C: 0-0-4-2 (P)

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Urine examination- physical, chemical, and microscopic examination. Ph, specific gravity, Glucose, protein, bile pigments, bile salts, urobilinogen,	3
II	Sputum examination, stool examination- physical chemical, microscopic and concentration floatation method. Gastric analysis-	3
III	Examination of CSF- physical, chemical and microscopic. Pregnancy test. Semen analysis-physical, chemical and microscopic. Pleural fluid analysis-physical, chemical, and microscopic.	3
IV	Pleural fluid analysis-physical, chemical, and microscopic. Pericardial fluid analysis- physical, chemical and microscopic. Synovial fluid analysis- physical, chemical, and microscopic.	3
TOTAL		12

Text Books:

1. Textbook of Medical Lab Technology- Praful B Godkar, Darshan P. Godkar
2. Medical laboratory Technology Methods and Interpretation-Ramniksood.
3. Parasitology-K.D. Chatterjee.
4. Medical Laboratory Technology by Sood 5th Edition, Jaypee Brothers.

Reference Book:

1. Clinical Diagnosis & Management -Todd & Sanford 19th edition 1996.
2. Lynch's Medical lab-Technology Latest edition.

Level: Semester I

Level; 400

Title of the Paper: Biochemistry -I (Theory+ Lab)

Subject Code: MLT244C102/ MLT244C112

L-T-P-C: 3-0-1-4 (T+ P)

Total credits: 4

Course Objectives: The course is designed to provide a wholesome Understand the chemistry of carbohydrate, lipids, the liver function tests in physiological and pathological disorders.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Bloom's Taxonomy Level
CO 1	To recall the core knowledge on chemistry of Carbohydrates, and their applied aspects.	BT 1
CO 2	To explain the chemistry of lipids and enzymes.	BT 2
CO 3	To develop a wide knowledge of the Liver function test, and their applied importance.	BT 3
CO 4	To analyze the various biochemical experiments related to urine examination etc	BT 4

COURSE OUTLINE:

Module s	Topics (if applicable) & Course Contents	Periods
I.	Chemistry of Carbohydrates: Definition and function, Classification, Isomerism of Monosaccharides, Properties of Monosaccharides, Modified Monosaccharides, Disaccharides, Polysaccharides. Chemistry of proteins: Definition, function of Proteins, Classification of amino acids, properties of Aminoacids, Classification and properties of proteins, Structural organization of proteins.	9
II	Chemistry of Lipids: Definition and function of Lipids, classification of lipids, Properties of Lipids. Nucleic acids: Nucleotides and its bases, DNA in details, RNA and its classification, High energy compounds. Enzymes: Classification of enzymes, factors affecting enzyme activity, Inhibitors, Specificity, Enzyme Kinetics, Enzymes in clinical diagnosis.	9
III	Clinical significance, principle of estimation-Bilirubin General types and jaundice, Liver function test: Bilirubin estimation, Alkaline phosphate and Acid phosphate estimation, SGOT, SGPT, Glucose tolerance test, Insulin tolerance test, Gastric juice analysis, Xylose absorption test, Analysis of calculi, Cerebrospinal fluid analysis: Composition and function of CSF, estimation of sugar and protein in CSF.	9

IV	Urine chemistry: Automation in Urine chemistry, Physical and chemical examination of Urine sample, common qualitative and quantitative tests of Urine, Clearance test for Urine function, Electrolytes; sodium, potassium, chloride, total and ionized calcium, phosphorus, magnesium. Blood gases, pH, carboxyhaemoglobin, O ₂ saturation, Disorder of carbohydrate metabolism, abnormalities of protein in plasma, disorders of plasma lipids and lipoprotein.	9
TOTAL		36

Text Books:

1. Harper Illustrated Biochemistry- N.V. Bhagvan- Academic Press 4th edition 2002.
2. Textbook of Biochemistry- A.S. Saini, C.B.S Publishers and distribution 2nd edition.

Reference Books:

1. Varley's Practical Clinical Biochemistry- Gowenlock and Bell William Heinmann, 6th edition 1992.
2. Clinical Chemistry- Theory analysis and Correlation- Kalpan.L.A. and Pesse A.G- C.V. Moslay and Company, New Delhi.

Title of the Paper: Biochemistry Lab I

L-T-P-C: 0-0-4-2 (P)

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Estimation of blood glucose, Estimation of protein, Estimation of serum creatinine, estimation of urea	3
II	Estimation of total cholesterol, Estimation of triglycerides, Estimation of HDL,	3
III	Estimation of SGOT, Estimation of SGPT, Estimation of Alkaline Phosphatase, Estimation of acid phosphatase.	3
IV	Estimation of bilirubin, Estimation of Na ⁺ , K ⁺ and Ca ⁺ , Estimation of urine through use of strips, estimation of T ₃ , T ₄ and TSH by elisa method.	3
TOTAL		12

Text Books:

1. Harper Illustrated Biochemistry- N.V. Bhagvan- Academic Press 4th edition 2002.
2. Textbook of Biochemistry- A.S. Saini, C.B.S Publishers and distribution 2nd edition.

Reference Books:

3. Varley's Practical Clinical Biochemistry- Gowenlock and Bell William Heinmann, 6th edition 1992.
4. Clinical Chemistry- Theory analysis and Correlation- Kalpan.L.A. and pesse A.G- C.V. Moslay and Company, New Delhi.

Level: Semester I**Level: 400****Subject: Immunology and Serology****Subject Code: MLT244C104****L-T-P-C: 2-0-4-4 (T+P)****Total credits: 4****Course Objectives:**

The objective of the course is to introduce students acquire knowledge of basic concepts of the immune system, including innate and adaptive immunity along with the structure, function, and interactions of immune cells and molecules (e.g., antibodies, cytokines, complement system). This course has been formulated to impart comprehensive knowledge on different types of serological techniques, including agglutination, precipitation, ELISA, Western blot, and immunofluorescence assays. To introduce the knowledge based on principles of monoclonal antibodies, vaccine development, and immune-based therapeutics.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To define antigen processing and presentation, immune responses, and immunological memory and recall the importance of role of immunomodulation in disease prevention and treatment.	BT 1
CO 2	To outline the structure, function, and interactions of immune cells and molecules like antibodies, cytokines, complement system and the importance of various experiments related to blood specimen and cells by preparation of different serological test.	BT 2
CO 3	To identify the different types of serological techniques, including agglutination, precipitation, ELISA, Western blot, and immunofluorescence assays and highlights the importance of various infectious diseases, autoimmune disorders, and blood typing.	BT 3

CO 4	To analyse and recognize the immunological basis of allergic reactions and hypersensitivity testing such as HIV, VDRL, TPHA etc.	BT 4
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Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Structure and function of Immune system, Introduction to immunity and its classification with details, discussion on cellular immune responses, Lymphocytes subsets and its functions, NK cells. Antigens and their properties, super antigens, heterophile antigens, Immunoglobulin and their structure and functions, Antigen-antibody reactions, Monoclonal antibody.	9
II	Major histocompatibility complex with its structure, functions, Complement and its properties along with activation and regulation of complement pathways and biological effects of complement. Brief introduction to immunodeficiency diseases and hyper sensitivity reactions, discussion on Autoimmunity.	9
III	Study of Bacterial vaccines and adjuvants, Study of serodiagnosis of bacterial infections: Enteric fever- WIDAL test, Syphilis- STS, VDRL test, RPR, Treponemal tests- TPHA, TPI, FTA-ABS. Streptococcal infections- ASO test, Anti DNase B, Anti- hyaluronidase test.	9
IV	Definitions of Infection, pathogenicity, virulence, primary infection, nosocomial infection and other types. Description of different types of infection and transmission to others. Brucellosis, Brucella agglutination test, Rickettsia fever, Primary atypical pneumonia, Weil Felix test, Serotyping of E.coli and Salmonella species, New rapid serological diagnostic methods for bacterial infections.	9
TOTAL		36

Text Books:

1. "**Kuby Immunology**" – Judy Owen, Jenni Punt & Sharon Stranfor Lewis
2. Textbook of Medical Lab Technology- Praful B. Godkar.
3. "**Roitt's Essential Immunology**" – Peter J. Delves & Seamus J. Martin
4. "**Clinical Immunology and Serology: A Laboratory Perspective**" – Christine Dorresteyn

Reference Books:

1. Medical Laboratory Technology Methods & interpretation- Ramnik Sood.

2. Textbook of Medical Laboratory Technology- Praful B. Godkar, Darshan P Godkar.

Subject: Immunology and Serology (Practical)

Subject Code: MLT244C112

L-T-P-C: 0--0-4-2 (P)

DETAILED SYLLABUS

Modules	Course Content	Periods
I	Demonstration of Indirect immunofluorescence method for detection of anti -nuclear antibodies (ANA), ELISA technique, Different types of Immunoglobulin (IgA, IgM, IgG, IgE, IgD) antibody test, Agglutination test, Precipitation test, neutralization test, opsonization test.	4
II	Immunoblotting technique, Diagnosis of allergic diseases by skin prick test(SPT), Handling of Electrophoresis, Flow cytometer, Demonstration of Anti-hyaluronidase antibody test.	4
III	Antigen preparation and standardization for WIDAL test along with interpretations. Common serological tests for the diagnosis of bacterial infections: VDRL test, RPR test, TPHA test, ASO test, Brucella agglutination test.	4
TOTAL		12

Text Books:

1. "Kuby Immunology" – Judy Owen, Jenni Punt & Sharon Stranfor Lewis
2. Textbook of Medical Lab Technology- Praful B. Godkar.
3. "Roitt's Essential Immunology" – Peter J. Delves & Seamus J. Martin
4. "Clinical Immunology and Serology: A Laboratory Perspective" – Christine Dorresteyn Stevens
5. "Practical Immunology" – Frank C. Hay & Olwyn M.R. Westwood
6. "Manual of Clinical Laboratory Immunology" – Noel R. Rose & Barbara Detrick.

Reference Books:

1. Medical Laboratory Technology Methods & interpretation- Ramnik Sood.
2. Textbook of Medical Laboratory Technology- Praful B. Godkar, Darshan P Godkar.
3. "*Abbas: Cellular and Molecular Immunology*" – *Abul K. Abbas, Andrew H. Lichtman & Shiv Pillai.*

Level: Semester I

Level: 400

Subject: Histo and Cytopathology(Theory+Lab)

Subject Code: MLT244C104/ MLT244C114

L-T-P-C: 2-0-4-4 (T+P)

Total credits: 4

Course Objectives:

The objective of the course is to introduce the students to Cells, Tissues, Classification of fixatives, Tissue Processing-Definition, Grossing, Dehydration, Clearing, Impregnation, Embedding, tissue cutting in the microtome and the principle behind the staining techniques.

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To recall about the classification of fixatives and details of each fixatives.	BT 1
CO 2	To explain the basic concept of tissue processing and the various steps involve in the staining process	BT 2
CO 3	To apply the knowledge of various principles of different stains and identify the different tissue and cells in practical class.	BT 3
CO 4	To analyze the difference between routine stains and special stain.	BT 4

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Introduction to histopathology Tissue- epithelial tissue, connective tissue, muscular tissue, nervous tissue. Managing the laboratory- Safety and organomic in the laboratory Fixation of Tissues and fixative, grossing, dehydration, Decalcification and tissue processing	9
II	Microtomy, Paraffin and Frozen section, Embedding/blocking, Staining of common histological stain and different types of Hematoxylin (Preparation and method of stain) Quality control in routine H&E stain, Special Histological stains.	9

III	Introduction to Cytology and its branches, Progressive changes of the cells, Course of cell injury and cell death, Specific non-neoplastic diseases affecting cells- inflammatory disorder, acute inflammation, subacute inflammation, chronic inflammation and granulomatous inflammation.	9
IV	Exfoliative cytology-Preservation, Sputum, bronchial aspirate, brush mucous rich sample, pleural, peritoneal, Gastric washing collected in normal saline and other Bloody fluids. Interventional cytology-Sites from where material is obtained, FNAC, staining techniques in cytology.	9
TOTAL		36

Title of the Paper: Histo and Cytopathology Lab I

L-T-P-C: 0-0-4-2 (P)

Detailed syllabus:

Modules	Topics (if applicable) & Course Contents	Periods
I.	Instrumentation- Hot air oven, Microtomy, tissue floatation bath.	3
II	Demonstration method of fixatives.	3
III	Method of sample receiving, registering, and labeling.	3
IV	MGG stain, PAP stain, H and E stain, PAS stain, Mucicarmine stain, Masson trichrome stain, Van Gieson's stain, and Zn stain.	3
TOTAL		12

Text Books:

1. Bancroft's theory and practice of Histological techniques by S.Kim Suvama, Christopher Layton, John D. Bancroft.
2. Histopathology, A self instructional text by Freida L. Carson.

Reference Books:

1. Textbook of Medical Laboratory Technology- Praful B. Godkar, Darshan P Godkar.
2. Medical Laboratory Technology Methods & interpretation- RamnikSood.
3. Manual of Medical Laboratory Technology Techniques by S.Ramakrishnan & KN Sulochana

Level: Semester I

Level: 400

Title of the Paper: Advanced Diagnostic Techniques (Theory)

Subject Code: MLT244C105

L-T-P-C: 3-1-0-4

Total credits: 4

Course Objectives

The course entails to educate the student about the basic concept on chromatography, basic concept on electrophoresis, centrifugation and all the immunoassays.

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To recall about the principles, types and applications of chromatography.	BT 1
CO 2	To identify the knowledge on different types of centrifugations and microscopy.	BT 2
CO 3	To apply mass spectroscopic and spectroscopics techniques in clinical diagnosis	BT 3
CO 4	To analyse the applications of different types of electrophoresis and its uses in clinical diagnosis.	BT 4

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Periods
I	Chromatography , its principle, types and applications. Paper Chromatography, Thin layer chromatography, HPLC, Gas liquid chromatography, Ion exchange chromatography and their application in diagnosis	16 hours
II	Centrifugation . Basic principles of sedimentation. Types, care and safety aspects of centrifuges, Preparative centrifugation, Analytical centrifugation Microscopy . Principles, parts & use of light microscope, Electron microscope, Fluorescence Microscope, Dark Ground Microscope, Phase Contrast Microscope. Care and maintenance of microscope	16 hours
III	Mass spectrometric techniques . Ionisation, Mass analysers, Detectors, Structural information by tandem mass spectrometry Spectroscopic techniques . Ultraviolet and visible light spectroscopy, Fluorescence spectroscopy, Nuclear magnetic resonance, X-ray diffraction	16 hours
IV	Electrophoresis . Basic Principle of electrophoresis, Paper electrophoresis, Gel electrophoresis, PAGE, SDS-PAGE, Agarose	16 Hours

	gel electrophoresis, buffer systems in electrophoresis. Electrophoresis of proteins and nucleic acids, haemoglobin, immunoglobulin's, isoenzymes Applications of electrophoresis in clinical diagnosis	
	Total	64

Text Books

1. Singh & Sahni, (2008), Introductory Practical Biochemistry, 2nd edition, Alpha science
2. Lehninger, (2013), Principles of Biochemistry, 6th edition, W H Freeman
3. Wilson & Walker, Practical Biochemistry, 2nd edition

Recommended Books:

1. Teitz, (2007), Fundamentals of Clinical Chemistry, 6th edition, Elsevier Publications
2. Henry's Clinical Diagnosis and Management by Laboratory Methods, (2011), 22nd edition, Elsevier

Level: Semester I

Level: 400

Title of the Paper: Biostatistics and Research Methodologies

Subject Code: MLT244C106

L-T-P-C: 3-1-0-4

Total credits: 4

Course Objectives

The course entails to educate the student about the basic concept on research, its approaches, the criteria of a good research. In this subject we learn how to collect data on research, the processing of data and testing on hypothesis.

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To recall about different methodology on research, an idea on good research, the different research problem faced while making a research.	BT 1
CO 2	To classify the different methods of design and data collection, the criteria for selecting a sample.	BT 2
CO 3	To apply the knowledge of processing and analyzing of data.	BT 3
CO 4	To analyze the application, steps, characteristics and limitations in a hypothesis.	BT 4

DETAILED SYLLABUS

Modules	Topics (if applicable) & Course Contents	Periods
I	Introduction: Introduction to research methodology: meaning, objectives of research, types of research, research approaches, significance of research, research process, criteria of good research, defining research problem: selecting the problem necessity and techniques in defining the problem.	16 hours
II	Research, sample design and data collection: Research Design: need and features of good design, types, basic principles of experimental design, developing a research plan. Sample design: criteria for selecting a sample procedure, characteristics of good sampling procedure types of sample design, selecting random samples. Methods of data collection: Collection of primary data, observation method, interview method, collection of data through questionnaire and schedules and other methods. Collection of secondary data, selection of appropriate method for data, collection, case study method, guidelines for developing questionnaire, successful interviewing, survey vs. experiment	16 hours
III	Processing and analysis of data: data analysis (elements), statistics in research, measures of central tendency, dispersion, asymmetry, regression analysis, multiple correlation and regression, partial correlation, association in case attributes Sampling Fundamentals: Definition, need, central limit theorem, sampling theory, concept of standard error, estimation, estimating population mean, proportion, sample size and its determination	16 hours
IV	Testing of hypothesis: Meaning basic concepts, important parametric tests, limitations of tests of hypothesis. Chi-square test: Applications, steps characteristics, limitations. Analysis of variance and co-variance: basic principles, techniques, applications, assumptions and limitations. Analysis of non-parametric tests	16 hours
	Total	64

Text books:

1. Research Design: Qualitative, Quantitative and Mixed Methods Approaches, 4th Edition, by John W. Creswell.
2. Qualitative Research: A Guide to Design and Implementation 4th edition, by Sharan B. Merriam (Author), Elizabeth J. Tisdell
3. Quantitative Inquiry and Research Design: Choosing Among Five Approaches 3rd Edition, by John W. Creswell

Recommended Books:

1. Fundamental of Research Methodology and Statistics by Y.K. Singh
2. Research Methodology Methods and techniques by C.R Kothari, Gaurav Garg.

Level: Semester II

Title of the Paper: Medical Bacteriology and Mycology

Subject Code: MLT244C201

L-T-P-C: 2-0-4-4

Total credits: 4 (T + P)

Course Objectives:

This course provides introduces theory including the host-microbe interactions, mechanisms of infection, and immune responses to microbial pathogens. It also take into to Identify clinically significant bacterial pathogens and their role in human diseases. Demonstrate proficiency in fungal culture, microscopic identification, and molecular diagnostic techniques. The course also presents Understand antiviral therapy, vaccine development, and emerging viral infections and epidemiology, and control measures for parasitic infections.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Describe the host-microbe interactions, procedures, biochemical tests, and molecular diagnostic methods.	BT 1
CO 2	Recognize the methods of Isolation and identification of bacteria.	BT 2
CO 3	To apply knowledge gained in the course in studying classification of fungi, Immunity to fungal infections, Serological tests for mycotic infection	BT 3
CO 4	Analyze Culture technique for fungal identification, collection, preservation and transportation	BT 4

DETAILED SYLLABUS

Modules	Course Content	Periods
I.	Applied Bacteriology: Nosocomial infections: Epidemiological aspects of control infections and diseases, hospital acquired infections, surgical acquired infections, Microbiology of air, bacteriology of water, milk, food and its born diseases, Automation in diagnostic microbiology. Molecular diagnostic methods: Automation in diagnostic microbiology, Quality in the clinical microbiology laboratory,	9

II.	<p>Systemic Bacteriology: Introduction to Systemic Bacteriology, Isolation and identification of bacteria.</p> <p>Medical importance of including Gram positive cocci: Staphylococcus, Micrococcus, Streptococcus, Enterococcus, Mycobacteria. Gram positive bacilli: Lactobacillus, Bifidobacterium, Listeria, Clostridium.</p> <p>Gram negative bacilli: Vibrio, Hemophilus, Brucella, Pseudomonas, Acitenobacter, Campylobacter, Spirochates.</p>	9
III.	<p>Medical Mycology: Introduction to Mycology, Classification of fungi, Immunity to fungal infections, Superficial mycosis- Pityriasis versicolor, dermatophytes.</p> <p>Subcutaneous mycosis: Mycetoma, Rhinosporidiosis, Chromoblastomycosis.</p> <p>Systemic mycosis- Histoplasmosis, Blastomycosis, Para Coccidioidomycosis.</p> <p>Opportunistic mycosis: Candidiasis, Aspergillosis, Zygomycosis, Penicillin.</p> <p>Common media and special stains used in mycology, Serological tests for mycotic infections, Mycotoxins.</p>	9
IV	<p>Ophthalmic fungal infection, Culture technique for fungal identification.</p> <p>Diagnostic Mycology: Epidemiology, pathogenesis, laboratory diagnosis of fungal infections, Specimen collection, preservation, transportation and identification of mycological agent, Anti- fungal agent, serological test for mycotic infections, preservation of fungus.</p>	9
TOTAL		36

Reference Books:

1. **Murray's Medical Microbiology**" – Patrick R. Murray, Ken S. Rosenthal & Michael A. Pfaller.
2. **"Jawetz, Melnick & Adelberg's Medical Microbiology"** – Geo. Brooks, Karen Carroll, Janet Butel & Stephen Morse.
3. **"Koneman's Color Atlas and Textbook of Diagnostic Microbiology"** – Elmer W. Koneman.
4. **"Garcia & Bruckner's Diagnostic Medical Parasitology"** – Lynne S. Garcia.
5. **"Fields Virology" (Volumes 1 & 2)** – David M. Knipe & Peter M. Howley.

Subject: Medical Bacteriology and Mycology (Practical)**Subject Code: MLT244C211****L-T-P-C: 0--0-4-2 (P)****DETAILED SYLLABUS**

Modules	Course Content	Periods
I	Microbial analysis of water, air, milk, food, PCR, RT-PCR	3
II	Study of morphological, culture and biochemical characters of common bacterial pathogens, bacterial infections of respiratory tract, GIT, food poisoning, UTI, Pyrexia of unknown origin.	3
III	Media and stains preparation for Mycology, Diagnostic methods in Mycotic infections, Study of Growth characteristics, Microscopic examination and identification of Medically important fungi.	3
IV	Collection, transportation and processing of specimens for mycological examination, Slide culture technique, Germ tube test for yeast identification, Serological tests in Mycology.	3
TOTAL		12

Text Books:

1. **Murray's Medical Microbiology**" – Patrick R. Murray, Ken S. Rosenthal & Michael A. Pfaller.
2. **"Jawetz, Melnick & Adelberg's Medical Microbiology"** – Geo. Brooks, Karen Carroll, Janet Butel & Stephen Morse.
3. **"Koneman's Color Atlas and Textbook of Diagnostic Microbiology"** – Elmer W. Koneman.
4. **"Garcia & Bruckner's Diagnostic Medical Parasitology"** – Lynne S. Garcia.
5. **"Fields Virology" (Volumes 1 & 2)** – David M. Knipe & Peter M. Howley.
6. **Textbook of Medical Lab Technology-** Praful B. Godkar.

Reference Books:

1. **Medical Laboratory Technology Methods & interpretation-** Ramnik Sood.
2. **Textbook of Medical Laboratory Technology-** Praful B. Godkar, Darshan P Godkar.

Level: Semester II**Level: 500****Subject: Hematology and Blood Banking (Theory+Lab)****Subject Code: MLT244C202/ MLT244C212****L-T-P-C: 2-0-4-4 (T+P)****Total credits: 4**

Course Objectives:

The objective of the course is to introduce students acquire knowledge of Formation of red blood cells, white blood cells, platelets, and understand the disorders related to the blood cells. This course has been formulated to impart comprehensive knowledge on different types of blood group system. To introduce the knowledge based on blood donation, preparation of patient, and post- donation care. The students will learn about the compatibility tests and how to prepare blood components.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To define what is haematopoiesis, leucocytosis, plasma cell disorders and recall the importance of different types of blood cells, and the related disorders etc.	BT 1
CO 2	To outline and the importance of various experiments related to blood specimen and cells by preparation of blood film.	BT 2
CO 3	To identify the different types of blood groups and classify the different types of blood donors, and highlights the importance of various indications of blood transfusion.	BT 3
CO 4	To analyse the different tests such as compatibility tests, coombs test, donor screening etc and get a proper concept of basic techniques in bloodbank.	BT 4

DETAILED SYLLABUS

Modules	Course Content	Periods
I.	Haematopoiesis: Origin, development, function and fate of blood cells. Erythropoiesis- Origin, development of RBCs, Disorders of RBC: Anaemia. Disorders of white blood cells- Leucocytosis, Leukopenia, Leukaemias Classification- (French American British- FAB classification) Lab investigation, Chronic myeloid leukaemia, Chronic Lymphocytic Leukaemia.	9
II.	Plasma cell disorder- classification, Plasma cell myeloma- definition, clinical features, Haemorrhagic disorders, vascular disorders, platelet disorder, coagulation disorders, Normal haemostasis. Organization and quality control in the laboratory,	9

III.	History of Transfusion Medicine, Blood groups and ABO System- ABO sub groups. Bombay group, Secretors, Non secretors. Du red cells (A variant of Rh system), MNS system, Blood transfusion- indications for blood transfusion, Rh system.	9
IV	Blood Donation, Donor registration, Donor selection, Blood collection, Adverse reaction. Anticoagulant used to store blood, Changes occurring in the stored blood. Blood group systems- antigen- antibody reaction , ABO system Forward grouping, reverse grouping, Coomb's test, Complatability testing- Major , Minor, Blood components- preparation of blood components.	9
TOTAL		36

Subject: Haematology and blood banking Lab

DETAILED SYLLABUS

Modules	Course Content	Periods
I	Blood collection, Anticoagulants used in Haematology, Red cell indices, ESR, PCV, Platelet count, Absolute Eosinophil count, Reticulocyte count, Stains used in Haematology.	3
II	Preparation of Blood film, Preparation of leishman stain, Interpretation of peripheral smear, Differential count, Investigation including serum Iron & TIBC. Different morphological investigation of pheripheral blood smear., BT, CT, PT, INR, APTT, TT, and quality control in the laboratory,	3
III	Blood grouping- ABO grouping, Forward grouping (Slide & Tube), Reverse grouping- Preparation of pooled A, B & O cells. Rh- antibody titration, direct and indirect, Preparation of coombs control cells, Compatibility testing. Other methods of grouping, Rh grouping & Rh typing (slide and tube method)	3
IV	Selection of blood donor, Crossmatching Techniques, Major, Minor, Saline, Albumin, Coomb's. Emergency Cross matching, pre and post Blood collection of donor. Donor selection, Post donation care, Preservation and storage of blood, Preparation and storage of blood components.	3
TOTAL		12

Text Books:

1. Practical Haematology- Daicie & Lewis, Barbara J. Bain, Imedlda Bates, Make A Laffan, S Mitchell Lewis
2. Textbook of Medical Lab Technology- Praful B. Godkar.
3. Clinical Haematology in Medical Practice- de Gruchy.
4. Clinical Haematology Principles, procedures, correlations by E. Anne Stiene Martin, Chery A. Lotspiech- steininger, John A. Koepke.
5. Principles & Practice of Transfusion Medicine by RN Makroo
6. The Textbook of Blood Bank and Transfusion Medicine -Satish Gupte.

Reference Books:

1. Medical Laboratory Technology Methods & interpretation- Ramnik Sood.
2. Textbook of Medical Laboratory Technology- Praful B. Godkar, Darshan P Godkar.
3. Manual of Transfusion Medicine-Ramadas Nayak.

Level- Semester II**Level: 500****Subject name: Biochemistry-II (T+P)****Subject Code: MLT244C203/MLT244C213****L-T-P-C: 2-0-4-4(T+P)****Total credits: 4****Course Objectives:**

The objective of the course is to introduce students acquire knowledge of the clinically important body fluids and the associated biochemistry. Also, focusing on different processes of sample collection and various methods of sample rejection criteria which gives the greatest impact on accuracy of result. This course has been formulated to impart comprehensive knowledge on different types of isoenzymes and their involvement in helping diagnose and monitor different medical conditions, emphasizing on their functions, and the associated clinical test.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To recall the clinically important body fluids and the associated biochemistry	BT 1

CO 2	To outline the crucial step of sample collection in diagnostic and research processes, ensuring the accuracy and reliability of the results.	BT 2
CO 3	To identify the different enzymes involved in various clinical tests, helping diagnose and monitor different medical conditions.	BT 3
CO 4	To analyze diagnostic procedures used to assess the functioning of the stomach and its ability to secrete digestive enzymes, acids, and other components involved in the digestion process..	BT 4

DETAILED SYLLABUS

Modules	Course Content	Periods
I.	Introduction to clinical biochemistry and body fluids. Definition and scope of clinical biochemistry in diagnosis, biochemistry of urine, blood and clinical entities in body fluids.	9
II.	Specimen collection and analysis. Collection of sample, sample acceptance and rejection criteria, transport of sample, storage of specimen for appropriate test, reference ranges.	9
III.	Introduction to Iso-enzymes: Lactate dehydrogenase, creatine kinase, aspartate amino amylase, isocitrate dehydrogenase., Enzymes as therapeutic agents, Enzymes used for diagnosis. Test based on blood levels of thyroid hormones - T3, T4, TSH. Test based on metabolic effects of thyroid hormone, Scanning of thyroid gland	9
IV	Organ Function Test: Liver function tests- Tests for Liver Function, Serum bilirubin, Classification of jaundice, Bile acids and bile salts, Tests based on metabolic capacity of liver, Tests based on synthetic function. Renal function tests- Urea clearance tests, Endogenous creatine clearance tests, Tests for renal blood flow, Test based on tubular function, Water dilution tests.	9
TOTAL		36

Subject: Biochemistry-II

L-T-P-C: 0--0-4-2 (P)

DETAILED SYLLABUS

Modules	Course Content	Periods
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I	Glucose tolerance test (GTT), Renal Function test (urea, creatinine, uric acid)	3
II	Liver Function Test (Total, Direct and Indirect Blirubin, SGPT , SGOT, albumin)	3
III	Demonstration of estimation of glycosylated hemoglobin (HbA1C), Quality control.	3
IV	Vitamins and hormone estimation. Thyroid Function Test (T3,T4,TSH)	3
TOTAL		12

Text Books:

1. Lehinger Principle of Biochemistry, David L Nelson, 7th edition, WH freeman Publishers
2. Fundamentals of biochemistry, JL jain and Sanjay Jain, S Chand Publishers.

Reference Books:

1. Text book of Medical Biochemistry – MN Chaterjee, Rana Shinde, Jaypee publishers.
2. Biochemistry, U. Sathyanarayana, Elsevier
3. Harper’s Biochemistry, 28th edition, Robert K Murray, Tata McGraw publishers

Level- Semester - II

Title of the Paper: Diagnostic Molecular Biology (T+P)

Subject Code: MLT244C204/MLT244C214

L-T-P-C: 2-0-4-4

Total credits: 4(T+P)

Course Objectives:

The course is designed with an objective to provide a basic introduction of molecular biology, role and importance of translation and transcription processes occurring within the living cell and techniques in molecular biology like PCR, RT-PCR etc

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To recall about the general concepts of nucleic acid and its types- DNA and RNA.	BT 1
CO 2	To explain how replication, transcription and translation processes occur within the living cell.	BT 2
CO 3	To apply the knowledge gained during the course in Performing the various practical activities.	BT 3

CO 4	To analyze the effects of various factors on molecular events such as replication, transcription and translation.	BT 4
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DETAILED SYLLABUS

Modules	Course Contents	Periods
I.	Nucleic Acids, DNA, RNA, composition, structure, types, denaturation and renaturation of DNA, chemistry of DNA	9
II	Basic transcription apparatus, Initiation, elongation and termination of transcription, Eukaryotic Transcription of mRNA, tRNA and rRNA, types of RNA polymerases, transcription factors Introduction of translation	9
III	Nucleic acid amplification testing, PCR, Principle, Types, applications, Thermal cycler, RT PCR, reverse transcriptase PCR, Nested PCR Blotting techniques, southern blotting and Western blotting	9
IV	Radioisotopes and its application in measurement of blood volume, determination of red cell volume and plasma volume, red cell life span, platelet life span, radiation hazards and its prevention disposal of radioactive material Introduction and applications of Flow cytometry, Stem cell banking, Prenatal Diagnosis	9
TOTAL		36

Subject: Diagnostic Molecular Biology Lab-I

L-T-P-C: 0-0-4-2 (P)

Modules	Course Content	Periods
I	PCR- Site Directed Mutagenesis, DNA Isolation.	3
II	DNA Cloning, Bacterial Transformation and Fusion Protein Purification.	3
III	(Demonstration only), Plasmid Analysis by Restriction Digestion.	3
IV	Protein gel Electrophoresis, DNA Gel Electrophoresis.	3
TOTAL		12

Recommended Books:

1. Basic Biotechnology (Paperback) By Colin Ratledge and Bjorn Kristiansen. Cambridge University

Press.

2. Introduction to Biotechnology (Paperback) By William J. Thieman and Michael A. Palladino. Benjamin Cummings; US Ed edition.

3. Recombinant DNA Principles and Methodologies By James Joseph Greene, CRC Press.

4. Molecular Biotechnology: Principles and Applications of Recombinant DNA (Paper-back) By Bernard J Glick and Jack J Pasternak. Publisher: American Society for Microbiology.

5. Laboratory Techniques in Biochemistry and Molecular Biology; DNA sequencing (Vol 10). By J Hindley. Elsevier Biomedical

Reference Book:

1. Teitz,(2007),Fundamentals of Clinical Chemistry,6th edition,Elsevier Publications

2. Henry's Clinical Diagnosis and Management by Laboratory Methods,(2011),22nd edition, Elsevier

3. Singh &Sahni,(2008),Introductory Practical Biochemistry,2nd edition, Alpha science Lehninger, (2013),Principles of Biochemistry,6th edition, W H Freeman

Level: Semester II

Level: 500

Subject: Medical laboratory management

Subject Code: MLT244C205

L-T-P-C: 3-1-0-4 (T)

Total credits: 4

Course Objectives: The main objective of the course is to Explain and apply principle of effective test utilization, Interpret, implement and complying law, regulation, accrediting standards and guidelines of Govt. and NG organizations. Design, implement and evaluate resources in lab Communicate effectively with laboratory personnel and health care professional.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Become professional competent in medical laboratory	BT 1
CO 2	Exhibit a sense of commitment to the ethical and human aspect of patient care	BT 2
CO 3	Recognize the role of clinical laboratory scientist in the assurance of quality health care	BT 3
CO 4	Application of safety and governmental regulation and standards as applied to medical laboratory practice.	BT 4

DETAILED SYLLABUS

Modules	Course Content	Periods
I.	The importance of laboratory quality Overview of the quality management system The quality management system model History of Laboratory quality management International laboratory standards	9
II.	Laboratory design Geographic or spatial organization Physical aspects of premises and rooms Safety management programme Identification of risks Personal protective equipment Emergency management and first aid Summary	9
III.	Equipments Overview Selecting and acquiring equipment Getting equipment maintenance programme Implementing an equipment maintenance programme Troubleshooting, service, repair and retiring equipment Equipment maintenance documentation	9
IV	Purchasing and inventory Overview Purchasing Implementing an inventory management programme Quantification Forms and logs Receipt and storage of supplies Monitoring inventory Summary	9
TOTAL		36

Reference Books:

1. Medical Laboratory Technology Methods & interpretation- Ramnik Sood.
2. Textbook of Medical Laboratory Technology- Praful B. Godkar, Darshan P Godkar

Specialization in Medical Microbiology

Level: Semester III

Level:500

Subject: Medical Parasitology

Subject Code: MLT244C30M1

L-T-P-C: 2-0-4-4 (T)

Total credits: 4 (T+P)

Course Objectives:

This course provides introduces theory including the host-microbe interactions, mechanisms of infection, and immune responses to microbial pathogens. It also take into to Identify clinically significant bacterial pathogens and their role in human diseases. Demonstrate proficiency in fungal culture, microscopic identification, and molecular diagnostic techniques. The course also presents Understand antiviral therapy, vaccine development, and emerging viral infections and epidemiology, and control measures for parasitic infections.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Describe the host-microbe interactions, mechanisms of infection, and immune responses to microbial pathogens including perform and interpret bacterial culture techniques, staining procedures, biochemical tests, and molecular diagnostics.	BT 1
CO 2	Recognize common parasites and their associated infections, morphology, life cycle and modes of transmission	BT 2
CO 3	To identify Arthropods as vectors of human disease	BT 3
CO 4	Analyse Vector control measures and Environmental pollution by pesticides	BT 4

DETAILED SYLLABUS

Modules	Course Content	Periods
I.	Introduction to medical parasitology, safety measures, classification of human parasites, Host- Parasite relationships. Morphology, transmission, life cycle and lab diagnosis of Protozoa: Entamoeba histolytica, Giardia lamblia, Trichomonas vaginalis, Leishmania donovani, L.tropiva, Balantidium coli, Plasmodium spp, Toxoplasma gondii, Babesia, Isospora, Cryptosporidium	9

II.	Morphology, transmission, life cycle and lab diagnosis of Trematodes, Cestodes, Nematodes: Schistosoma spp, Fasciola spp, Taenia spp, Echinococcus granulosus, Ascaris lumbricoides, Filaria, Enterovius vermicularis, Strongyloidesstercoralis.	9
III.	Introduction to entomology, Arthropods as vectors of human disease: Arthroponotic diseases, Zoonotic diseases, role of arthropods in the transmission of disease: House flies, sand flies, human lice, bed bugs, ticks and mites, Fleas, Louse and mosquitoes.	9
IV	Vector control measures, Principle of Integrated vector management (IVM) and Insect Pest management (IPM), Pesticides along with inorganic and organic pesticides and their mode of actions, Environmental pollution by pesticides and safe handling practice of pesticides.	9
TOTAL		36

Reference Books:

1. **Murray's Medical Microbiology**" – Patrick R. Murray, Ken S. Rosenthal & Michael A. Pfaller.
2. **"Jawetz, Melnick & Adelberg's Medical Microbiology"** – Geo. Brooks, Karen Carroll, Janet Butel & Stephen Morse.
3. **"Koneman's Color Atlas and Textbook of Diagnostic Microbiology"** – Elmer W. Koneman.
4. **"Garcia & Bruckner's Diagnostic Medical Parasitology"** – Lynne S. Garcia.
5. **"Fields Virology" (Volumes 1 & 2)** – David M. Knipe & Peter M. Howley.

Subject: Medical Parasitology (Practical)

Subject Code: MLT244C31M2

L-T-P-C: 0--0-4-2 (P)

DETAILED SYLLABUS

Modules	Course Content	Periods
I	Preparation of stains and reagents: Leishman, Giemsa, Fields, Carbol fuschin and phosphate buffer. Macroscopic and microscopic examination of stool for adult worms, ova, cysts, larvae.	3

II	Concentration techniques for intestinal parasites in stool, Preparation of culture media for parasite cultivation, Preparation of thick and thin smear, staining with Hematoxylin, Leishman and Giemsa stains for detection of blood parasites.	3
III	Detection and differentiation of malarial parasites in stained blood smears, urine examination	3
IV	Microscopic examination of lung aspirates and sputum, liver aspirates, skin biopsy, vaginal and urethral swabs,	3
TOTAL		12

Text Books:

1. **Murray's Medical Microbiology**" – Patrick R. Murray, Ken S. Rosenthal & Michael A. Pfaller.
2. **"Jawetz, Melnick & Adelberg's Medical Microbiology"** – Geo. Brooks, Karen Carroll, Janet Butel & Stephen Morse.
3. **"Koneman's Color Atlas and Textbook of Diagnostic Microbiology"** – Elmer W. Koneman.
4. **"Garcia & Bruckner's Diagnostic Medical Parasitology"** – Lynne S. Garcia.
5. **"Fields Virology" (Volumes 1 & 2)** – David M. Knipe & Peter M. Howley.
6. Textbook of Medical Lab Technology- Praful B. Godkar.

Reference Books:

1. Medical Laboratory Technology Methods & interpretation- Ramnik Sood.
2. Textbook of Medical Laboratory Technology- Praful B. Godkar, Darshan P Godkar.

Level: Semester III

Level:500

Subject: Medical Virology

Subject Code: MLT244C30M3

L-T-P-C: 2-0-4-4

Total credits: 4 (T+P)

Course Objectives:

This course provides introduces theory including the host-microbe interactions, mechanisms of infection, and immune responses to microbial pathogens. It also take into to Identify clinically significant bacterial pathogens and their role in human diseases. Demonstrate proficiency in fungal culture, microscopic identification, and molecular diagnostic techniques. The course also presents Understand antiviral therapy, vaccine development, and emerging viral infections and epidemiology, and control measures for parasitic infections.

Course Outcomes:

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level

CO 1	Describe morphology and structure of viruses and Bacteriophages and methods of cultivation and isolation of viruses	BT 1
CO 2	Outline test structure, classification, and replication of viruses relevant to human health	BT 2
CO 3	To identify the clinical specimens for viral diagnosis	BT 3
CO 4	To analyse systemic study of RNA virus	BT 4

DETAILED SYLLABUS

Modules	Course Content	Periods
I.	Medical Virology: General characteristics and classification of viruses, Morphology and structure of viruses and Bacteriophages, different methods of cultivation and isolation of viruses, cell culture containers and cleaning, Preparation of media, reagents and solutions, Description of common cell culture.	9
II.	Systemic Virology: Adenovirus, Human Papillomavirus, Parvo virus B19, Herpesviridae, Poxviridae: Small pox and Cow pox, Rotavirus, Norwalk virus, Coxsackie virus, Enterovirus, polio virus.	9
III.	Diagnostic Virology: Collections, preservations, transportation, processing, Isolation and identification of the clinical specimens for viral diagnosis (Skin lesion, vesicle fluid, biopsy specimens, nasopharyngeal secretions). Serological diagnosis of viral infection: Paul Bunnel test, Hemagglutination test, viral neutralization tests.	9
IV	Systemic study of RNA virus: Flaviviridae virus: Dengue, HCV, Yellow fever, Zika virus Orthomyxoviridae: Influenza virus A, B and C Paramyxoviridae: Measles, Mumps Rabies and Ebola virus, Coronaviridae virus: SARS-COV-2, MERS, COVID-19.	9
TOTAL		36

Reference Books:

1. **Murray's Medical Microbiology**" – Patrick R. Murray, Ken S. Rosenthal & Michael A. Pfaller.
2. **"Jawetz, Melnick & Adelberg's Medical Microbiology"** – Geo. Brooks, Karen Carroll, Janet Butel & Stephen Morse.
3. **"Koneman's Color Atlas and Textbook of Diagnostic Microbiology"** – Elmer W. Koneman.
4. **"Garcia & Bruckner's Diagnostic Medical Parasitology"** – Lynne S. Garcia.
5. **"Fields Virology" (Volumes 1 & 2)** – David M. Knipe & Peter M. Howley.

Subject: Medical virology (Practical)**Subject Code: MLT244C31M4****L-T-P-C: 0--0-4-2 (P)****DETAILED SYLLABUS**

Modules	Course Content	Periods
I	Animal cell cultures, media sterilization and demonstration of different type of cell lines, demonstration of egg inoculation, serological tests for viral infections.	6
II	Demonstration of immunofluorensence technique, western blot technique, ELISA and IFA viral disease diagnosis, Sero diagnosis of Viral diseases: HBV, HCV and HIV.	6
TOTAL		12

Text Books:

1. **Murray's Medical Microbiology**" – Patrick R. Murray, Ken S. Rosenthal & Michael A. Pfaller.
2. **"Jawetz, Melnick & Adelberg's Medical Microbiology"** – Geo. Brooks, Karen Carroll, Janet Butel & Stephen Morse.
3. **"Koneman's Color Atlas and Textbook of Diagnostic Microbiology"** – Elmer W. Koneman.
4. **"Garcia & Bruckner's Diagnostic Medical Parasitology"** – Lynne S. Garcia.
5. **"Fields Virology" (Volumes 1 & 2)** – David M. Knipe & Peter M. Howley.
6. **Textbook of Medical Lab Technology-** Praful B. Godkar.

Reference Books:

1. **Medical Laboratory Technology Methods & interpretation-** Ramnik Sood.
2. **Textbook of Medical Laboratory Technology-** Praful B. Godkar, Darshan P Godkar.

Specialization in Hematology and Blood banking

Level: Semester III

Level: 500

Subject: Immunohematology (Theory + Lab)

Subject Code: MLT244C30H1/ MLT244C31H2

L-T-P-C: 2-0-4-4

Total credits: 4

Course Objectives:

The objective of the course is to introduce students acquire knowledge of Formation of red blood cells, white blood cells, platelets, and understand the disorders related to the blood cells. This course has been formulated to impart comprehensive knowledge on different types of blood group system. To introduce the knowledge based on blood donation, preparation of patient, and post- donation care. The students will learn about the compatibility tests and how to prepare blood components.

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To define what is haematopoiesis, leucocytosis, plasma cell disorders and recall the importance of different types of blood cells, and the related disorders etc.	BT 1
CO 2	To outline and the importance of various experiments related to blood specimen and cells by preparation of blood film.	BT 2
CO 3	To identify the different types of blood groups and classify the different types of blood donors, and highlights the importance of various indications of blood transfusion.	BT 3
CO 4	To analyse the different tests such as compatibility tests, coombs test, donor screening etc and get a proper concept of basic techniques in bloodbank.	BT 4

Modules	Course Content	Periods
I.	<p>ANEMIA</p> <p>Introduction: General considerations</p> <p>Clinical effects. Evaluation and classification</p> <p>Disorders of iron metabolism - Iron deficiency and related disorders – IDA, pathology, clinical features, etiology, signs and symptoms, laboratory, evaluation, and management.</p> <p>Sideroblastic anemias -Classification, clinical and laboratory features.</p> <p>Hemolytic anemias- General considerations, classification, clinical features, mechanism of cell destruction, laboratory evaluation.</p>	9
II.	<p>SICKLE CELL ANAEMIA</p> <p>Pathophysiology, molecular basis of sickling, Sickle cell anaemia (HbSS).</p> <p>Clinical features, laboratory features, diagnosis. Sickle cell trait- clinical features & diagnosis.</p> <p>Other sickling syndromes.</p> <p>Thalassemia, pathophysiology, clinical features, laboratory diagnosis. Other Hbopathies.</p>	9
III.	<p>MEGALOBLASTIC ANAEMIA</p> <p>Normal physiology and pathophysiology, clinical and laboratory features.</p> <p>Inherited & Acquired Aplastic Anaemia syndromes - Diagnostic approach to clinical management.</p> <p>Fanconi anaemia Clinical and laboratory features. Diagnostic testing. Pathophysiology.</p> <p>Erythrocytosis- definition & terminology, physiology, classification and approach to the patients. Polycythaemia.</p>	9

IV	<p>LEUKEMIAS</p> <p>Introduction, Molecular genetics, Advances in technology.</p> <p>Acute and chronic leukemia - Classification, pathophysiology, clinical features, and laboratory findings.</p> <p>Myeloproliferative disorders Introduction, clinical features, laboratory</p> <p>Myelodysplastic syndrome – introduction, features, etiology, classification.</p>	9
TOTAL		36

Text Books:

1. Practical Haematology- Daicie & Lewis, Barbara J. Bain, Imedlda Bates, Make A Laffan, SMitchell Lewis
2. Textbook of Medical Lab Technology- Praful B. Godkar.
3. Clinical Haematology in Medical Practice- de Gruchy.
4. Clinical Haematology Principles, procedures, correlations by E. Anne Stiene Martin, Chery A. Lotspiech- steininger, John A. Koepke.
5. Principles & Practice of Transfusion Medicine by RN Makroo
6. The Textbook of Blood Bank and Transfusion Medicine -Satish Gupte

Subject: Immunohematology Lab

Subject Code: MLT244C31H2

Modules	Course Content	Periods
I	Laboratory investigation of hemoglobinopathies: CBC, Hb, TRBC count, MCV & RDW	3
II	Laboratory identifications of megaloblastics anemia, Iron deficiency anemia, hemolytic anemia, microscopic examination of blood: normal and abnormal, Sickling test.	3

III	Special tests: osmotic fragility test, Heinz body preparation, LE Cellpreparation, Test for Iron and TIBC in serum, detection of G-6-PD deficiency.	3
IV	Bone marrow: Smear preparation and fixation, routine stain, MGG, PAS, sudan black, iron, fats	3
TOTAL		12

DETAILED SYLLABUS

Text Books:

1. Practical Haematology- Daicie & Lewis, Barbara J. Bain, Imedlida
Bates, Make A Laffan, SMitchell Lewis
2. Textbook of Medical Lab Technology- Praful B. Godkar.
3. Clinical Haematology in Medical Practice- de Gruchy.
4. Clinical Haematology Principles, procedures, correlations by E.
Anne Stiene Martin, Chery A. Lotspiech- steininger, John A.
Koepke.
5. Principles & Practice of Transfusion Medicine by RN Makroo
6. The Textbook of Blood Bank and Transfusion Medicine -Satish Gupte.

Reference Books:

1. Medical Laboratory Technology Methods & interpretation- Ramnik Sood.
2. Textbook of Medical Laboratory Technology- Praful B. Godkar, Darshan P Godkar.
3. Manual of Transfusion Medicine-Ramadas Nayak.

Level: Semester III

Level: 500

Subject: Transfusion medicine and Coagulation (Theory + Lab)

Subject Code: MLT244C30H3/ MLT244C31H4

L-T-P-C: 2-0-4-4

Total credits: 4

Course Objectives:

The objective of the course is to introduce students acquire knowledge of Formation of red blood cells, white blood cells, platelets, and understand the disorders related to the blood cells. This course has been formulated to impart comprehensive knowledge on different types of blood group system. To introduce the knowledge based on blood donation, preparation of patient,

and post- donation care. The students will learn about the compatibility tests and how to prepare blood components.

Course Outcomes:

On successful completion of the course the students will be able to:		
CO 1	To define what is haematopoiesis, leucocytosis, plasma cell disorders and recall the importance of different types of blood cells, and the related disorders etc. Describe hemostasis including platelet structure, physiology and function, intrinsic and extrinsic coagulation pathways, terminology and factors involved in the coagulation process	BT 1
CO 2	To outline and the importance of various experiments related to blood specimen and cells by preparation of blood film. Recognize general clinical findings of coagulation disorders including platelet function disorders, clotting factor disorders and DIC and their laboratory findings	BT 2
CO 3	To identify the different types of blood groups and classify the different types of blood donors, and highlights the importance of various indications of blood transfusion. Recognize test principle and patient results associated with the following: thrombin time, fibrinogen levels, factor XIII assays, FDPs, D-dimer, mixing studies, heparin assay and platelet function assay.	BT 3
CO 4	To analyse the different tests such as compatibility tests, coombs test, donor screening etc and get a proper concept of basic techniques in bloodbank. Recall principles of methods, selection and use of appropriate analytical equipment; and perform advanced laboratory tests for PT, APTT, INR, Protein C and S and bleeding time tests.	BT 4

DETAILED SYLLABUS

Modules	Course Content	Periods
I	<p>Blood Group System – ABO blood Group system, subgroup of ABO, Variants of ABO blood group system.</p> <p>Rh blood group system.</p> <p>Other Blood Group systems</p> <p>Normal hemostasis- Introduction, Physiological control</p> <p>Primary and Secondary hemostasis.</p> <p>Role of the vascular system, Structure and functions of blood vessels.</p> <p>Clinical evaluation of bleeding patients.</p> <p>Manifestations of disordered hemostasis.</p>	9
II	<p>Compatibility Testing, Transfusion Reaction and HDN Compatibility testing and special methods of routine and emergency cross match Types of Transfusion reaction Investigation of Transfusion reaction.</p> <p>Haemolytic disease of Newborn due to ABO, Rh or Other blood group incompatibility Blood Collection & Component Preparation.</p> <p>Miscellaneous bleeding manifestations.</p> <p>Bleeding disorders caused by vascular abnormalities.</p> <p>Platelets in hemostasis, Platelet production Structure and function of platelets.</p>	9
III	<p>Screening of Donor. Phlebotomy of Blood Donor. Storage and transportation of blood. Mandatory screening tests-HIV1&HIV2, HBsAg, HCV, RPR & Malaria. Component preparation: Red cell concentrate; Fresh Frozen Plasma; Cryoprecipitate; Platelet concentrate. Automation, Biosafety and Quality Control in Blood Banking.</p> <p>Mechanical purpura structural malformations of vessels.</p> <p>Preanalytical variables including sample collection.</p> <p>Performance of coagulation tests.</p>	9
III	<p>Automation in Blood collection. Automation in blood grouping, Cross matching. Bio safety and Biomedical waste management. Quality Control in blood banking. Prothrombin time, Activated Partial Thromboplastin time, Thrombin time</p> <p>Principle, method, Reagents, Normal values, Interpretation, expression of results.</p> <p>Measurement of fibrinogen - Fibrinogen assay.</p>	9
	TOTAL	36

Text Books:

1. Practical Haematology- Daicie & Lewis, Barbara J. Bain, Imedlda Bates, Make A Laffan, SMitchell Lewis
2. Textbook of Medical Lab Technology- Praful B. Godkar.
3. Clinical Haematology in Medical Practice- de Gruchy.
4. Clinical Haematology Principles, procedures, correlations by E. Anne Stiene Martin, Chery A. Lotspiech- steininger, John A. Koepke.
5. Principles & Practice of Transfusion Medicine by RN Makroo
6. The Textbook of Blood Bank and Transfusion Medicine -Satish Gupte.

Reference Books:

1. Medical Laboratory Technology Methods & interpretation- Ramnik Sood.
2. Textbook of Medical Laboratory Technology- Praful B. Godkar, Darshan P Godkar. Manual of Transfusion Medicine-Ramadas Nayak.

Subject: Transfusion medicine and Coagulation (Lab)**DETAILED SYLLABUS**

Modules	Course Content	Periods
I	Laboratory screening of donors blood. Blood grouping- ABO grouping, Forward grouping (Slide & Tube), Reverse grouping- Preparation of pooled A, B & O cells. Routine hemorrhagic disorder tests: BT, CT, Clot retraction and lysis time, platelet count, platelet aggregation studies,	3
II	Coombs test: Direct and indirect coombs test. Rh- antibody titration, direct and indirect, Preparation of coombs control cells, Compatibility testing. Other methods of grouping, Rh grouping & Rh typing (slide and tube method). General approach to investigation of hemostasis: PT, APTT, TT, Mixing studies. Coagulation factor assays, Factor VIII inhibitor studies,	3

III	Selection of blood donor, Crossmatching Techniques, Major, Minor, Saline, Albumin, Coomb's. Emergency Cross matching, pre and post Blood collection of donor. Platelet Aggregation studies, thrombic work-up, D-dimer tests, FDP	3
IV	Donor selection, Post donation care, Preservation and storage of blood, Preparation and storage of blood components. Protein C, protein S, anti-thrombin – III, Factor V Leiden, Antiphospholipid antibody workup.	3
TOTAL		12

Text Books:

1. Practical Haematology- Daicie & Lewis, Barbara J. Bain, Imedlda Bates, Make A Laffan, SMitchell Lewis
2. Textbook of Medical Lab Technology- Praful B. Godkar.
3. Clinical Haematology in Medical Practice- de Gruchy.
4. Clinical Haematology Principles, procedures, correlations by E. Anne Stiene Martin, Chery A. Lotspiech- steininger, John A. Koepke.
5. Principles & Practice of Transfusion Medicine by RN Makroo
6. The Textbook of Blood Bank and Transfusion Medicine -Satish Gupte.

Reference Books:

1. Medical Laboratory Technology Methods & interpretation- Ramnik Sood.
2. Textbook of Medical Laboratory Technology- Praful B. Godkar, Darshan P Godkar.
3. Manual of Transfusion Medicine-Ramadas Nayak.

Level: 500

Title of the Paper: IPR, Biosafety and Bioethics

Subject Code: MLT244C303

L-T-P-C: 3-1-0-4

Total credits: 4

Course Objectives. This subject aims to introduce students to Intellectual Property Rights and apprise them of ethical issues in the biological sciences and the laws pertaining to these in both the global and national context. This course would help students to also adhere to the ethical practices appropriate to the various scientific disciplines at all times and to adopt safe working practices relevant to the different biotech industries & fields of research.

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	Estimate the risk of recurrence of various inherited disorders in affected families	BT 1
CO 2	Explain the essential elements of genetic counseling and indications for prenatal Diagnosis	BT 2
CO 3	Estimate the risk of recurrence of various inherited disorders in affected families	BT 3
CO 4	Explain the essential elements of genetic counseling and indications for prenatal Diagnosis	BT 4

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Periods
I	<p>Concept of Property: Tangible and Intangible Property, Intellectual Property-Origin Development and Objectives, Classification of Intellectual</p> <p>Property-Patents, Copyright, Trademark, Industrial Design, Geographical</p> <p>Indications, Protection of Plant Varieties and Traditional Knowledge,</p> <p>Relevance of Intellectual Property Rights for Science and Technology;</p> <p>Patentability Criterion-Discovery and Invention, Patentable Subject Matters;</p>	16 hours
II	<p>Novelty, Utility (Industrial Applicability), Non-Obviousness (Inventive Step)</p> <p>and Written Description, Product Patents vis-à-vis Process Patents;</p> <p>Patentability of Biotechnology Inventions; Patent Laws in Indian</p>	16 hours

	and International Perspective; Indian Patent Act 1970 (Patent Amendment Acts- 1999, 2002 and 2005); International Conventions relating to Intellectual Property; General Agreement on Trade and Tariff (GATT); Trade Related Aspects of Intellectual Property Rights (TRIPS)	
III	Biosafety: Definition and requirement; Important symbols and their meaning, Biosafety in relation to human health, environment, transgenic research and applications; International Legal Instruments on Biosafety Cartagena Protocol on Biosafety, Nagoya Protocol Laws relating to Biosafety in India: The Biological Diversity Act, 2002, Biosafety procedures, rules and guidelines under Environment (Protection) Act 1986 and Rules 1989; Biosafety Regulation: Principles and Practices in Microbial and Biomedical Labs; Guidelines for research involving genes; Regulatory bodies at National and International level.	16 hours
IV	Nature, Concept and Relevance of Bioethics; Basic Principles of Bioethics; Legal, Social and Economic Impacts of the Products and Techniques in Biotechnology; Bioethics in Plants, Animals and Microbial Genetic Engineering; Ethical issues in Healthcare; Biopiracy and Bioethics: Application of IPR regime to Biological Resources and Biopiracy, Access to Biological Resources, Benefit Sharing and Informed Consent	16 Hours
	Total	64

Text books:

1. Cornish, W. R., Intellectual Property (Latest Edition)
2. Intellectual Property Rights by Paul Goldstein
3. Intellectual Property Rights by K. R. G. Nair, Ashok Kumar, K. R. G. Nair
4. Kilner, John, et.al, eds., Cutting-Edge Bioethics. Eerdmans 2002.

Reference Books:

1. B.L. Wadera, Patents, Trademarks, Copyright, Designs and Geographical Indications

2. S. Ignacimuthu, Bioethics, Alpha Science International, Limited (2009)
3. Matthew Rimmer, Intellectual Property and Biotechnology: Biological Inventions (2008)
4. Arthur L. Caplan, Robert Arp, Contemporary Issues in Bioethics (2014)

Level: 500

Title of the Paper: Cytogenetics and molecular genetics

Subject Code: MLT244C304

L-T-P-C: 3-1-0-4

Total credits: 4

Course Objectives

The course entails to educate the student about Knowledge of basic cytogenetic laboratory techniques SP2 necessary to prepare tissue samples or cytogenetic diagnosis.

Course Outcomes

On successful completion of the course the students will be able to:		
SI No	Course Outcome	Blooms Taxonomy Level
CO 1	To review recent case reports and text from the cytogenetics CP1 literature, to become familiar with the fields of genetics and cytogenetics, and applications to clinical medicine.	BT 1
CO 2	Understand the importance of genetics in personalized CP2 medicine	BT 2
CO 3	Estimate the risk of recurrence of various inherited disorders in affected families	BT 3
CO 4	Explain the essential elements of genetic counseling and indications for prenatal Diagnosis	BT 4

Detailed Syllabus

Modules	Topics (if applicable) & Course Contents	Periods
I	History of cytogenetics, Chromosome analysis, Cytogenetic Nomenclature, Structure of genes - Classifications of genetic disorders. Mendelian disorders/Single gene disorders (Classification with examples), Definition & examples of numerical chromosomal abnormalities	16 hours

II	Down syndrome Klinefelter's syndrome - Turners syndrome- Gaucher's disease Niemen Pick disease Laboratory investigations of genetic disorders	16 hours
III	Karyotyping, Barr body identify. DNA structure, replication, organization of prokaryotic and eukaryotic genome Cell division - Mitosis and Meiosis Techniques employed - FISH, CGH, PCR - Flow cytometry Transcription and translation	16 hours
IV	Application of recombinant DNA technology in medicine TCR, RFLP, DNA fingerprinting - Gene therapy Applications of molecular genetic testing in non-malignant disorders.	16 Hours
	Total	64

Text Books:

1. Gupta P.K., Genetics, ISBN-10 8171339328, ISBN-13 978-8171339328, Rastogi Publications, Meerut.
2. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., Molecular Biology of the Gene, 7th edition, 2012. Cold Spring Harbour Lab. Press, Pearson Pub.
3. Fairbanks, D.J., Genetics: The Continuity of Life, Wadsworth Publishing, ISBN-10: 0534252796
4. Russel, P.J., iGenetics, Pearsons Education India, ISBN-10: 9332571627, ISBN-13: 978-9332571624

Reference Books:

1. Karp, G..Cell and Molecular Biology: Concepts and Experiments, 6th edition, 2010. John Wiley & Sons. Inc.
2. Klug, W., Cummings, M., Spencer, C.A., Palladino, M.A., Concept of Genetics, ISBN-10: 9789332577466, ISBN-13: 978-9332577466, Pearsons Education India.

Level: Semester IV

Project/ Dissertation

Code: MLT244C421

Total credits: 12 (P)

Course Objectives:

This dissertation in **Medical Laboratory Technology (MLT)** aims to develop research skills, critical thinking, and practical application of laboratory sciences in healthcare. By the end of the dissertation, students should be able to formulate a clear and focused research question or hypothesis relevant to medical laboratory sciences and also organize research findings into a structured dissertation, including an abstract, introduction, methodology, results, discussion, and conclusion.

Level: Semester IV

PROJECT/DISSERTATION

Each candidate pursuing Msc. MLT course is required to carry out work on selected research to carry out work on selected research project/dissertation under the guidance of a recognised post graduate teacher in same field.

The dissertation/research project is aimed to train a graduate student in research methods and techniques. It includes identification of problem, formulation, formulation of hypothesis, search and review of the literature, design of the research study, collection of data, analysis of data, interpretation of results and finally frame conclusions.

The dissertation / research project should be written under following heading:

INTRODUCTION

AIMS OR OBJECTIVES OF STUDY

FORMULATION HYPOTHESIS

REVIEW OF LITERATURE

MATERIALS AND METHODS

RESULTS

DISCUSSION AND INTERPRETATION

CONCLUSION

SUMMARY

REFERENCES

TABLES

ANNEXURE

SYNOPSIS Every candidate should submit a synopsis to the registrar of the university in the prescribed format containing particulars of proposed dissertation work after obtaining ethical clearance from the Institutional Ethical Committee comprising principal and other senior faculty of the college within 6 months from the date of admission on or before the date notified by the university.

The synopsis shall be sent through the proper channel. Such synopsis will be reviewed and the dissertation topic will be registered by the university.

Synopsis should be written under following heading:-

Proposed research project topic

Introduction

Aim of Study

Objective of the study

Formulation hypothesis

Review of literature

Materials and methods

Statistics

References

The written text of synopsis shall not exceed 8(eight) pages including all the above mentioned topics.

DISSERTATION SUBMISSION

The candidate should submit their dissertation work at the end of 10 months of second year of the M.sc. MLT course.

The candidate should submit six (6) copies of dissertation (with hard binding) to the Principle/Head of the Institution. Institute shall be submitted four (4) copies of dissertation to the registrar on the 22nd month of the commencement of course on or before the date notified by the university.

EVALUATION OF DISSERTATION

Dissertation valuation of the candidates will be conducted by the Internal and External examiners together on the basis of work, presentation and defense viva at the time of second year M.sc. MLT practical examination.

STANDARD FORMAT OF DISSERTATION

The written text of dissertation shall not be less than 100 pages and shall not exceed

150 pages excluding references, tables, questionnaires and annexure. It should be neatly typed (font size 12 – Time New Roman or font size 123 Arial) in double line spacing on one side of the bond paper (A-4 Size) and bound properly. The Guide and the head of the Institution shall certify the dissertation.

CHANGE OF DISSERTATION TOPIC/ GUIDE

No change in the dissertation topic/guide shall be made without prior approval from the university.

ABSTRACT

Abstract provides a brief summary of the dissertation/thesis, summing up clearly the problem examined, the methods used, and the main findings. The abstract is a one-paragraph, self-contained summary of the most important elements of the paper. The abstract word limit is between 250 and 300 words. All numbers in the abstract (except those beginning a sentence) should be typed as digits rather than words. Key words (max.10) should be given, chosen from subject concerned headings. Each word should be separated by semicolon.

GENERAL PRINCIPLES

PAPER

Use only one side of high quality, plain white (unlined in any way) bond paper, minimum 20-lb weight, and “8 ½ x 11” in size. Erasable paper should not be used.

TYPE SIZE AND PRINT

The font size should be visible to the reader, preferably Times New Roman 12 pt. No italicization. Size of the title should be 14 and bold; the size of sub-title should be 12 and bold. Print should be letter quality or laser (not dot matrix) printing with dark black characters that are consistently clear and dense. Use the same type of print and print size throughout the document.

PAGINATION

Number all of the pages of your document, including not only the principal text, but also all Plates, tables, diagrams, maps and so on. Roman numerals are used on the preliminary pages (Pages up to the first page of text) and Arabic numerals are used on the text pages. The numbers themselves can be placed anywhere on the page, however they should be consistent.

SPACING

Use double spacing except for long quotations and foot notes which are single spaced.

MARGINS

Margin size; “generous”- Use plenty of room on the top, bottom, left & right (1” minimum). To allow for binding, the left hand margin must be 1.5”. Other margin should be 1.0”.

Diagrams or photographs in any form should be a standard page size, or if larger, folded so that a free left-hand margin of 1.5” remains and the folded sheet is not larger than the standard page.

PHOTOGRAPHS

Professional quality black-and-white photographs are necessary for clear reproduction. Colors are allowed, but you should be certain the colored figure will copy clearly and will not be confusing when printed in black and white.

FILE FORMAT

Dissertation format should be in Doc (Ms Word document) or PDF (portable document Format), Image file in JPG or TIFF format and audio visual in AVI (Audio Video Interleave), GIF, MPEG (moving picture expert) files format.