

# **COURSES OFFERED BY THE DEPARTMENT OF MEDICAL LABORATORY SCIENCE**

## **FIRST YEAR FIRST SEMESTER**

### **AH 1101 English & Communication Skills I (Non-credit)**

Language Development and Writing (English for Academic Purposes-EAP): Parts of speech, Use of parts of speech in medical context, The main sentence structures in English, Different kinds of phrases, Developing writing skills: schemata and static description. Listening: Introduction to basic listening skills: brain storming, identifying key words, note taking: pattern notes, linear notes, Practicing note taking- flow charts, tree diagrams, labeling diagrams, tables, etc. Reading: Surveying a text book, Skimming and scanning an article, Previewing an article, Identifying the main idea and the topic of a paragraph. Vocabulary: introducing dictionary skills, Phonetics symbols, Pronunciation, etc., Punctuations of sentences (using of capital letters). Speech: Greeting and introducing (self and others), Making requests, Asking for and giving permission, Offering help, Giving instructions and directions, Telephone skills. (Note: All four language skills: Reading, Writing, Listening and Speaking, are incorporated in teaching)

Assignments – 40%      End semester -60%

### **AH 1102 Information Technology (Non-credit)**

Fundamentals basic concept of computers, System Analysis and Design , Data Processing, Data Communication, Practical-Internet and E-mail, Web Page Development, Languages.

End semester: Theory – 50%, Practical – 50%

### **AH 1103 Basic Human Anatomy (Credits -02)**

Organization of the human body, embryology, cardiovascular system, lymphatic system, respiratory system, digestive system, genito- urinary system, endocrine system, musculoskeletal system, nervous system, sensory organs.

Assignments – 25%      End semester: Theory – 50%, Practical – 25%

### **AH 1104 Human Physiology I (Credits -02)**

Organisation of the body for function, homeostasis, body fluids, blood, temperature regulation, growth and development, ageing, cardiovascular system, lymphatic system, respiratory system, digestive system, urinary system, reproductive system, pregnancy and lactation, endocrine system, musculo-skeletal system, nervous system, sensory organs.

Mid Semester – 30%      End semester: 70%

### **AH 1107 Basic Biochemistry (Credits-02)**

Structure and function of cell organelles, structure and function of carbohydrates, lipids, amino acids, proteins and nucleic acids, biochemical tests for identification of carbohydrates, lipids & proteins, pH and buffers, enzyme properties and kinetics, chemistry & function of haemoglobin, chemistry and functions of vitamins, plasma protein and their functions, metabolism of carbohydrates, lipids, proteins and amino acids, integration and regulation of metabolic pathways.

Mid semester -30%      End semesters -70%

**ML 1101      Laboratory practice, Safety and First Aid      (Credits -02)**

Introduction to the course & the laboratory tests, the organization and design of a testing laboratory, hazards associated with laboratories and means of prevention, use of the bio safety manual in prevention of laboratory accidents, sterilization and disinfection, laboratory waste disposal, occupation health in the laboratory, introduction to the concept of quality, use of safety cabinets, safety aspects of using radioisotopes, storage of chemicals and safety aspects, safety aspects in processing human samples, washing glassware for laboratory use, waste disposal related to laboratories, design a modern diagnostic laboratory (assignment), First-Aid workshop (compulsory)

Assignments – 20%      End semester -80%

**ML 1102      General Microbiology      (Credits-02)**

Introduction to Microbiology, history of Microbiology, taxonomy and classification of microbes, microbial variety (prions, viruses, bacteria, Fungi and parasites), microbial metabolism and growth, microbial habitat and transmission, microbial pathogenicity, Koch's postulates and proof of causation, principles of detection and identification of microorganisms, microbiological specimen collection and transport, microbiology of air and water, storage of microorganisms, bacterial genetics, antimicrobial sensitivity testing, basic microbiological techniques [preparation of Gram stain and quality control, preparation of different types of media (Blood agar/ MacConkey agar/ LJ media) & reagents for biochemical tests (urea/KIA) and inoculation, preparation of smears and perform Gram stain, spore stain, ZeihlNeelsen stain, capsular stain & Albert stain, motility testing, identification of organisms using surface components, antibiotic sensitivity testing]

Assignments /Lab- 20%      Mid semester -30%      End semester -50%

**ML 1103      Basic Physics, Electronics & Instrumentation      (Credits-02)**

Basic concepts and terminology, electrical circuit analysis, bridge circuits, semiconductor components, diodes, basic electronics, rectification and power supplies, introduction to computer hardware, A/D and D/A conversions, instrumentation, principles and parts of medical equipments (analytical balance, osmometer, refractometer, hydrometer, water bath, incubators, oven, autoclave, safety cabinet, etc.).

Assignments-15%      Mid semester -30%      End semester -55%

**ML 1104 Applied Biochemistry      (Credit- 02)**

Laboratory resources, laboratory water and cleaning of lab ware, laboratory calculations, preparation of laboratory reagents, titrations, spectrophotometry (atomic absorption spectrophotometry, flame emission photometry, fluorometry), electrophoresis, chromatography, measurement of enzyme activity, centrifugation, Ionometry.

Assignments/Labs-20%      Mid semester-20%      End semester-60%

## **ML 1105 Genetics and Molecular Biology (Credits-02)**

Mendelian inheritance, laws of inheritance, major genes, polygenes, dominance, recessiveness, sex linked inheritance, pedigree analysis, cytogenetics and chromosomal aberrations, molecular genetics, DNA structure, function, gene expression, genome and human genome project, translation and replication, modern biotechnology, recombinant DNA technology, transformation products, vaccines, drugs, hormones, gene therapy and disease diagnosis, DNA extraction, PCR, electrophoresis, ELISA.

Mid semester -25%                      End semester -75%

## **FIRST YEAR SECOND SEMESTER**

### **AH 1201 English & Communication Skills II (Non-credit)**

Language Development and Writing (English for Academic Purposes-EAP): Study of the use of verbs in detail (transitive/ intransitive, active/passive, types of verbs), Introduction to relative clauses, Laboratory report writing: present/past tense, active/passive voice, present perfect tense, modal auxiliary verbs, Dictation. Listening: Improving listening skills through subject based and general talks/mini-lectures/speeches, etc., Activities and exercises based on the above., Reading: Note making while reading, Reading comprehension-general and academic, Identifying contextual references, Rephrasing, Vocabulary development, and Individual loud reading. Prefixes and suffixes, Root words (Latin/Greek) related to medical terminology, Activities incorporated with reading lessons. Speech: Activities consolidated with parallel Grammar, Reading and Listening lessons. (Note: All four language skills: Reading, Writing, Listening and Speaking, are incorporated)

Assignments – 40%                      End semester -60%

### **AH 1202 Basic Statistics (Credits -02)**

Description of statistics, organizing and displaying data, summarizing data and variation, curve fitting, probability, simple regression and correlation, test of hypothesis and significance, student “t”, “F” and chi-square distributions, analysis of variance.

Assignments – 10%                      Mid semester -30% End semester -60%

### **AH 1203 General Pathology (Credits -02)**

Introduction to general pathology, acute inflammation, chronic inflammation, cell damage, apoptosis, necrosis, gangrene, principles of fracture healing and complications, wound healing and complications, calcifications / degenerations, hypertrophy / atrophy / hyperplasia / metaplasia / dysplasia, immunology, neoplasia, tumour markers / molecular basis of tumours, ischaemia and infarction, thrombosis / embolism / atherosclerosis / oedema / congestion and heart failure, pigmentation, genetic basis of disease.

Mid semester -25%                      End semesters -75%

### **AH 1204 Human Physiology II (Credits -02)**

Body fluids, blood, heart and circulatory system, respiratory system, digestive system, urinary system, reproductive system, endocrine system, musculo-skeletal system, nervous system, special senses.

Mid semester -20% End semesters -80%

### **ML 1201 Haematotechnology I (Credits-03)**

Specimen collection, introduction to haematology laboratory and glassware preparation, ESR, haemopoiesis, composition of blood, haemoglobin, determination of Hb & PCV, determination of RCC and red cell indices, preparation of blood film & common problems in film preparation, red cells & red cell inclusions, abnormalities of red cell morphology, reticulocytes & reticulocyte count, white cells & determination of WBC & DC, morphology & function of platelets & platelet count, automated haematology analyzers, determination of laboratory errors, anaemia, iron deficiency anaemia, megaloblastic anaemia.

Assignments/Labs-05% Mid semester -30% End semester -65%

### **ML 1202 Clinical Biochemistry I (Credits-03)**

Structure and function of kidney, formation & composition of urine, principles of renal diseases, systemic disorders associated with biochemical changes in urine, specimen collection for urine analysis, physical and chemical examination of urine, examination of urine deposits, special urine examination, urinary stone diseases & chemical analysis of calculi, identification of the pre-analytical & analytical errors, spermatogenesis & male infertility, seminal fluid analysis, diseases of CNS, CSF analysis, exudates & transudates, examination of other body fluids.

Assignments-10% Mid semester -30% End semester -60%

### **ML 1203 Systematic Parasitology and Medical Entomology (Credits-02)**

Introduction to parasitology and intestinal protozoa, tissue protozoa, intestinal nematodes, tissue nematodes, trematodes, cestodes, medically important mosquitoes & other arthropods

Assignments-10% Mid semester -30% End semester -60%

### **ML 1204 Tissues of the Body (Credits-01)**

Introduction, epithelial tissue, connective tissue, bone, cartilage, muscle and cardiovascular system, urinary system, male and female reproductive system, liver, gastrointestinal tract & associated organs, respiratory system, reticulo-endothelial system, lymphoid tissue, spleen, lymph nodes, Nervous system, introduction to tissue processing.

Mid semester -40% End semesters-60%

## **SECOND YEAR FIRST SEMESTER**

### **AH 2101 English & Communication Skills III (Non-credit)**

Language Development and Writing: The four main types of sentences, Different kinds of clauses, Expansion of sentence structures, Cause-effect relationship, Comparisons, Listening: Developing listening skills through audio/video based learning, Exposure to native and non-native speakers of English (different accents), TOEFL practice tests, Reading: Practicing the reading skills (skimming, scanning, etc.) developed in AH 1101 and AH 1201 through activities such as, pre-reading (discussion through brain storming, puzzles, etc.), skimming and scanning, comprehension, vocabulary expansion related activities leading towards a final speech activity: presentation of a report, poster, etc., and Individual loud reading. Vocabulary: Vocabulary related to specific fields (law, business, politics, etc.), Fixed expressions: Everyday expressions, Idioms, Proverbs, etc., Speech: Mini-presentations based on Reading and Listening activities. Presenting reading reports.

Assignments – 40%      End semester -60%

### **AH 2102 Basic Research Methodology (Credits-01)**

Philosophy of science and the notion of truth, principles of evidence based practice and clinical effectiveness/efficiency, traditions, preferences and positions in applied qualitative research, narrative methodologies and their use in clinical/professional practice, quantitative reasoning and its application in clinical/professional practice, data gathering tools/approaches – qualitative and quantitative methods and analysis, practice based inquiry/participative inquiry/generating evidence based practice, case studies, ethics in research, describe the foundations used for ethical decision-making, patients' rights, need of a code of ethics for practice.

Assignments -25%      End semester-75%

### **ML 2101 Clinical Biochemistry II (Credits-03)**

Regulation and abnormalities of carbohydrate metabolism, diabetes mellitus, specimen collection and methods of glucose determination, tests of glucose metabolism & lipoprotein metabolism, abnormalities of lipid metabolism, liver function tests, jaundice and bilirubin metabolism, acute and chronic liver disease, uses of liver function test, protein metabolism.

Assignments/Lab-10%      Mid semester-30%      End semester-60%

### **ML 2102 Cytotechnology (Credits-02)**

Introduction to cytotechnology, overview of cytopreparatory techniques, cytological sampling of female genital tract, respiratory tract, GIT & body cavities, CSF and urine cytology, skin scrapings, needle aspiration biopsies, basic cervical cytology, ancillary techniques in cytology, error identification, techniques of concentration of cytological samples, quality assurance in cytology.

Assignments/Lab-10%      Mid semester-30%      End semester-60%

### **ML 2103 Haematotechnology II (Credits-03)**

Haemolytic anaemia, reticulocyte count, G6PD deficiency, thalassaemia and haemoglobinopathies, investigations and interpretation of thalassaemia and other haemoglobinopathies, interpreting haemoglobin electrophoresis, leukaemia, pancytopenia and aplastic anaemia, myeloproliferative disorders, bone marrow smears, LE cells, paraproteinaemias, blood coagulation disorders and coagulation tests.

Assignments/Lab-10% Mid semester -30% End semester -60%

### **ML 2104 Virology and Mycology (Credits-02)**

Introduction to fungi, classification and general properties of fungi, yeasts (*Candida*, *Cryptococcus*), dimorphic fungi, dermatophytes, filamentous fungi pathogenic to humans. Practicals on diagnostic mycology; Gram, colony, germ tube testing and negative stain; KOH preparation of material – skin, hair, nails and culture on Saboraud's agar and slide culture.

Introduction to viruses-classification and general properties of viruses; DNA viruses (Pox, Parvo, Papova and Adeno viruses; Herpes viruses); Hepatitis viruses; RNA viruses (Respiratory viruses; gut related viruses – Enteroviruses and diarrhoeal viruses; arboviruses (dengue, JE, chikungunya and others); zoonotic viruses including rabies; retroviruses and prions); maternal viral infection that affect the foetus and neonate; pathogenesis and control of viral diseases. practicals on diagnostic virology (Rapid assays and ELISA); Cell culture and the use of cell culture in the viral diagnosis.

Assignments/Lab-20% Mid semester-30% End semester-50%

### **ML 2105 Systematic Bacteriology (Credits-02)**

Characteristic features, pathogenicity, clinical conditions and identification tests of Staphylococci, Streptococci, Gram positive bacilli, Enteric Gram negative bacilli, Pseudomonas and other non-enteric Gram negative bacilli, Vibrio, campylobacter and Helicobacter, Parvobacteria, Neisseria, Anaerobes, Mycobacteria, Spirochaetes, Mycoplasma, Chlamydia and Rickettsiae.

Assignments/Lab-20% Mid semester -30% End semester-50%

### **ML 2106 Histotechnology (Credits-02)**

Introduction to histotechnology and histotechnology equipment, sample collection and fixation basic steps in histotechnology, tissue processing, paraffin embedding & section cutting (microtomy), haematoxylin and eosin staining and staining artifacts, special staining techniques, frozen sections, processing of fresh specimens and cryostat sectioning, micrometry, immunohistochemistry (immunofluorescence and enzyme histochemistry), quality assurance methods in histotechnology.

Assignments/Lab-10% Mid semester-30% End semester-60%

### **ML2107 Diagnostic Parasitology (Credits-01)**

Microscopy, micrometry relevant to parasitology, collection, transport and preservation of specimens, faecal examination- wet smears (Iodine, saline, eosin), concentration techniques, culture techniques, permanent staining trichrome, iron- haematoxylin, acid fast stains, blood examination- malaria, blood examination- filariasis, concentration techniques, immunodiagnosis and molecular diagnosis, arthropods of medical importance- preservation and transport to

reference labs, quality control and quality assurance in parasitology, Preservation and transport of medical important arthropods to reference labs.

Assignments/Lab-10% Midsemester-30% End semester-60%

## **SECOND YEAR SECOND SEMESTER**

### **AH 2201 English & Communication Skills IV (Non-credit)**

Language Development and Writing: Development of writing skills–Transitional devices, paragraph building, process writing, reports such as nurse’s reports etc., Listening: Developing listening skills through audio/video based learning, Exposure to native and non- native speakers of English (different accents), TOEFL practice tests. Reading: Reading comprehension activities leading towards a final speech activity: presentation of a report, poster, etc., and Individual loud reading. Homonyms, Synonyms, Acronyms, Homophones, Phrasal verbs, Varieties of English, Abbreviations. Speech: Presenting reports, Debates, Activities consolidated with parallel grammar, reading and listening lessons. (Note: All four language skills: Reading, Writing, Listening and Speaking are incorporated) Assignments – 40% End semester -60%

### **ML 2201 Diagnostic Microbiology (Credits-02)**

Normal flora and collection and transport of specimens, respiratory tract infections, gastrointestinal infections, sexually transmitted infections, central nervous system infections, bacteraemia/infective endocarditis, skin and wound infections, urinary tract infections, ENT and eye infections, infection in the compromised host, antibiotics and antibiotic sensitivity testing, choice of appropriate test in an infective disease and quality assurance in a microbiology Laboratory.

Assignments/Lab-20% Mid semester -30% End semester -50%

### **ML 2202 Clinical Biochemistry III (Credits-03)**

Enzymes, Clinical Enzymology, Disease markers in heart disease, Tumor markers, Gynecological tumour markers, Renal diseases and renal function tests, Water & mineral metabolism, serum electrolytes, Flame photometry, Endocrine Physiology, Endocrine system and functions, Thyroid function Tests, Thyroid disorders

Assignments/Lab-05% Quizzes-05% Mid semester -30% End semester -60%

### **ML 2203 Haematotechnology III (Credits-02)**

Sample collection for different tests, Blood bank, Blood grouping, Blood transfusion, Cross matching, Compatibility testing, Rh blood group system, Coomb’s test – Direct and Indirect, Leucodepletion, Laboratory diagnosis of Hepatitis B virus, Haemolytic disease of new born, Preparation of reagents.

Assignments/Lab -10% Mid semester-30% End semester-60%

### **ML 2204 Public Health Microbiology (Credits-01)**

Introduction to public health microbiology, Food borne disease outbreaks, Food-borne microbial pathogens, General mechanisms of pathogenesis of food borne pathogens - Food borne infections, Infection dose, colonization and adhesion factors, invasion and intracellular residence, iron acquisition, motility and chemotaxis, Evasion of immune system, Intoxication, Toxicoinfection, Genetic regulation and secretion systems for virulence factors, Control of

microorganisms in food, Microbial indicators of faecal contamination of food and water, Microbial quality of drinking water, Detection and enumeration of microorganisms in food and water, Conventional methods, Rapid/ advanced methods, International standards and certification relating food and water safety.

Mid semester -30%                      End semesters -70%

**ML 2205    Specimen Collection & Transport    (Credits-02)**

Venepuncture, Finger prick specimen, Anticoagulants, Serum separation & effects of various procedures, Specimen collection for haematology, biochemistry, Microbiology, histopathology Specimen collection in urine analysis, special conditions, Preparation of patients for investigations, Specimen processing, Safety aspects in specimen collection, Detecting problems in specimen collection

Assignments/Lab-20%    Mid semester -20%    End semester -60%

**ML 2206    Immunotechnology    (Credits- 02)**

Immunology : Introduction, Antigens, Antibodies & humoral immunity, Antigen - antibody reactions , Complement system, Lab. diagnosis of autoimmunity, Lab. diagnosis of immunodeficiency, Immunotechnology, Immunoagglutination, Immunohistochemistry, Antibody titres, Immunofluorescence, Radio-immunoassay, ELISA, Immuno-electrophoresis, Flowcytometry

Mid semester-30%                      End semester -70%

**ML 2207    Laboratory Quality Assurance    (Credits-02)**

Introduction to Quality Assurance (QA), Concepts of Quality Control (controls, precision and accuracy, specificity, sensitivity, standards and calibrators, random and systematic errors, internal and external quality control, reference ranges), QA procedures, documentation and interpretation (basic terms, Leve Jennings charts, Westgard rules, cumulative summation limit, Youden plot), systematic troubleshooting (troubleshooting, corrective action), establishment of verification of method performance specifications, monitoring quality, quality indicators, internal audit, tools that support the quality, guidelines of clinical laboratory accreditation.

Tutorials-10%                      Mid semester -30%                      End semester -70%

**ML 2208    Management for Laboratory Manager    (Credits -02)**

Scope of medical laboratory management, laboratory planning and organization, specimen management and processes, personal management and training, equipment management, financial management, chemical management and ordering process, data management and statistics, health and safety in laboratory, medical laboratory waste management (routine and special), basics of quality management system.

Assignments/Lab-10%                      Mid semester -20%                      End semester -70%

**THIRD YEAR FIRST SEMESTER**

**ML 3101    Specimen Collection Externship and Manual    (Credits-01)**

Basic and specific laboratory procedures adopted to collect specimens in the fields of Haematology, Clinical Biochemistry, Microbiology and Cytology

Externship book-60%                      Manual-40%



**ML 3102 Work Based Learning (Haematotechnology I) (Credits-03)**

Preparation of glassware for haematology, measurements of haemoglobin, PCV, red cell count, white cell count and differential counts, blood film preparation and staining (Leishman staining), ESR, platelet count, bleeding time, clotting time, APTT and prothrombin time, reticulocyte count (new methylene blue), full blood count, blood pictures (anaemia, thalassaemia, leukaemia).

Attendance+ student log book-05% Theory-50% Practical-45%

**ML 3103 Work Based Learning (Histotechnology I) (Credits-03)**

Collecting procedure, collecting containers, tissue accession, labeling / request forms, tissue logging, preparation of fixatives for histological work, preparation of tissue specimens for processing, decalcification and assessment, dehydration procedures (manual and automatic), clearing, wax impregnation and embedding, trimming, cutting and mounting, theory of different types of staining mechanism, H&E staining of tissue slides, examination of H&E stained slides.

Attendance+ student log book-10% Theory-45% Practical-45%

**ML 3104 Work Based Learning (Clinical Biochemistry I) (Credits-03)**

Specimen collection and transport, specimen processing and manual analytical techniques, urine full report, urine ketone bodies, bile etc., urine specific gravity, seminal fluid analysis, body fluid analysis, blood glucose (FBS, PPBS, OGTT), blood urea, BUN, serum creatinine, serum bilirubin, serum proteins, serum electrolytes.

Attendance+ student log book-05% Theory-50% Practical-45%

**ML 3105 Work Based Learning (Microbiology I) (Credits-03)**

Specimen collection and transport, processing of specimens, culture of urine, blood, sputum, swabs, CSF, body fluids, stools, tissue culture, virus culture, fungal cultures, gram stains, methylene blue /ZN stain, negative stain and identification of capsules. preparation of stains / reagents / preparation of culture media, sterilisation and disposal of cultures (autoclave), hanging drop and motility testing, identification of bacteria including biochemical tests such as oxidative tests, coagulase test, catalase test and other tests used for this purpose, laboratory safety measures (GLP), quality control of stains, media and reagents used for testing, accreditation of laboratories.

Attendance + Student log book-20%practicals-50%Assignments-30%

**ML 3106 Work Based Learning (Blood Bank Serology) (Credits-02)**

Blood grouping, cross matching, Coomb's tests - direct and indirect, preparation of blood components /products, antibody screening, antibody inspection, genotyping, Rh antibody titres, cold antibody titres, rare blood groups, problems in grouping and cross matching, HLA typing.

Attendance+ student log book-05% Theory-60% Practical-35%

**ML 3107Work Based Learning (Night Laboratory) (Credits-01)**

Urgent diagnostic tests performed in emergencies, reporting of night laboratory test results

Attendance+ student log book-05% Theory-20% Practical-75%

**ML 3108 Work Based Learning(Sexually Transmitted Diseases) (Credits-01)**

Laboratory diagnosis of HIV infection (strip test, ELISA, particle agglutination test), syphilis (VDRL, TPPA, TPHA), gonorrhoea (direct smear- gram stain, culture, ABST), chancroid (direct smear – gram stain), vaginitis (trichomoniasis – direct microscopy, candidiasis – direct microscopy/ 10% KOH preparation/ gram stain/ culture, bacterial vaginosis – wet mount / gram stain)

Attendance + Student log book-20% Practical-80%

**THIRD YEAR SECOND SEMESTER**

**ML 3201 Work Based Learning (Haematotechnology II) (Credits-04)**

Special haematological investigations, investigation of haemolytic anaemia, osmotic fragility test, special coagulation tests, factor assay and correlation test, bone marrow-slide preparation and staining, examination of marrow specimens, Hb electrophoresis, preparation of Hb standards, preparation of stains/ reagents, alkaline denaturation test, glycosylated Hb tests, special staining techniques such as pearl staining, solubility test, sickling test.

Attendance + Student log book- 10% Theory-35% Practical-45%

Case study presentation-10%

**ML 3202 Work Based Learning (Histotechnology II) (Credit-04)**

Preparation of special stains, special staining techniques, frozen sections, cryostat sections, immunohistochemistry, enzyme histochemistry, transport of fresh and other special type of specimens, special care in handling chemicals used in histotechnology, identification of histotechnological errors in prepared slides, automation in the histology laboratory, quality assurance in Histotechnology.

Attendance + Student log book- 20% Theory-40% Practical-40%

**ML 3203 Work Based Learning (Clinical Biochemistry II) (Credits- 03)**

Use of automated biochemistry analysers, specimen collection and processing for special biochemical tests and special urine tests, SGOT/SGPT, serum amylase, alkaline phosphatase etc., CSF full report, CSF proteins and sugar, serum lipids, cholesterol, lipid profile, aspiration fluid full report, sugar and proteins, preparation of reagents, standards, QC samples, serum protein electrophoresis, serum uric acid, creatinine clearance, preparation of 24 hour urine bottles, urine micro albumin.

Attendance + Student log book- 10% Theory-40% Practical-40%

Case study presentation-10%

**ML 3204 Work Based Learning (Microbiology II) (Credits-02)**

Skills training in a healthcare associated diagnostic microbiology laboratory to include isolation and identification of micro-organisms, quality control in a diagnostic microbiology laboratory, antibiotic sensitivity testing, serology in a diagnostic microbiology laboratory.

Attendance + Student log book- 10% Procedure manual-20% Theory-30% Practical - 40% Case study presentation-10%

**ML 3205 Work Based Learning (Medical Parasitology & Entomology) (Credits- 01)**

Preparation and examination of wet faecal smears (saline and iodine) for protozoans and helminthic infections, preparation and staining (Leishman /Giemsa stain) of blood smears and identification of malaria parasites, blood film staining, examination and identification of filarial parasites, rapid diagnostic tests, immunological tests such as FAT, ova identification-concentration techniques, worm identification, preparation, staining and identification of *Leishmania* and *Toxoplasma*, *Trichomonas*, tape worm segments and eggs, preparation of stains, mosquito larva and adult identification, other important arthropod vectors; flies, ticks, mites, fleas, lice etc.

Attendance + Student log book- 20% Theory-40% Practical -40%

**ML 3206 Scientific Writing and Presentations (Credits-01)**

Introduction to scientific writing, Guidelines for writing – title and abstract, Ethics, Literature survey, Introduction, experimental/ Methods and Material selection, Results, discussion, Conclusions, References, Structure and Layout of a Thesis/ Project Report, Students are supposed to retrieve literature on given scientific topic and self selected 2 topics approved by the department and collate the information into a hand written script not less than 5 pages with the given format. They are required to prepare teacher guided power point presentations on each topic and make the presentations in front of peers and teachers. Each student is expected to question their peers on rotation basis during the discussion period

Assignments- 30% Presentations-30% End of Semester (Theory/ Essay)-40%

**ML 3207 Work Based Learning (Immunotechnology and Hormone assays) (Credits - 02)**

Agglutination test, immuno-histochemical tests, antibody titres, immunofluorescence, RIA, ELISA, immunoelectrophoresis, flowcytometry, flocculation test, precipitation tests, nephelometry, strip tests.

Attendance + Student log book- 20% Theory-40% Practical-40%

**ML 3208 Work Based Learning (Cytotechnology and Laboratory Management) (Credits-01)**

Calculate monthly work load using specimen registers, calculate and prepare annual indent, reception and storage of hazardous and non-hazardous laboratory chemicals, maintain major laboratory equipment, make local purchasing according to financial regulations, documentation of local purchases, identify major and minor supplies for effective laboratory work, repair and remove unserviceable equipment, maintain laboratory inventory registers, document the laboratory plan/ develop emergency procedures, preparation of fixative for cytological work, FNA cytology staining & examination, PAP smear staining & screening, preparation of stains

Attendance + Student log book- 20% Theory-40% Practical-40%

## **FOURTH YEAR FIRST SEMESTER**

### **AH 4101 English & Communication Skills V (Non-credit)**

Scientific writing: What is a scientific paper, Different types of sources of literature, Keeping a card index, Project proposals, The parts of a scientific paper – IMRAD, Titles, Headings and numbering, Abstract, Reference styles, Contents page, Page numbering, Tables, Figures, Appendices, Acknowledgements, Scientific English.

Assignments – 40% End semester -60%

### **AH 4102 Applied Statistics (Credits-02)**

Additive and non-additive ANOVA models, Mean separation, incidence data and proportions, odds and odds ratios, models for proportions, non-parametric methods for two-sample case; independent sample and paired observations, non-parametric methods for data from designed experiments.

Assignments – 25% Midsemester -25% End semester -50%

### **AH 4103 Proposal Formulation and Presentation (Credits-02)**

Introduction to undergraduate research project proposal, selection of priority research areas, justification, formulation of research objectives, Development of research hypothesis, Literature survey and citation of references, Planning and Development of research proposal, Formulate the research design, Preparation of the presentation & improving presentation skills

Continuous Assessment-50% End course assessment-50%

### **AH 4104 Human Resource Management (Credits-02)**

Introduction to management, History of HRM, Definitions and principles of HRM, Introduction to SHRM, Recruitment and selection, Training & development, Performance management, Reward management, Employee relations, Industrial Law, HRM relating to performance in health sector, Use of IT in HRM, Roles and responsibilities for HR & HR outsourcing, Group assignment on HR practices of an organization

Assignment-30% End semester -70%

### **ML 4101 Clinical Laboratory Accreditation (Credits-02)**

Introduction to laboratory accreditation, ISO 15189 standards, sequence of accreditation, preparation of necessary documents for accreditation, management and technical principles, method of internal auditing, measurement of uncertainty for different tests, calibration of equipment, identify the opportunities for continual improvement within an organization.

Mid semester -30% End semester -70%

### **ML 4102 Scientific Seminars (Credits-02)**

Students are supposed to retrieve literature on given 2 scientific topics and self selected 3 topics approved by the department and collate the information into a hand written script not less than 5 pages with the given format. They are required to prepare teacher guided power point presentations on each topic and make the presentations in front of peers and teachers. Each student is expected to question their peers on rotation basis during the discussion period.

Assignments- 30% Presentations-30% End of Semester (Theory/ Essay)-40%

**ML 4103 Biotechnology (Credits-02)**

Nucleic acid structure and function, DNA replication, transcription, translation, chromosome structure, remodeling and regulation of gene expression in prokaryotes and eukaryotes. Extended topics to be covered including the methods in advanced recombinant DNA technology, microarrays, and micro-RNA, functional genomics, mechanisms of differential gene expression, DNA methylation, silencers, enhancers, genomic imprinting, microarray analysis and DNA fingerprint

Assignments/ Labs-30% Midsemester -20%End semester -50%

**ML 4104 Bioethics and Professional Issues (Credits-01)**

Introduction and definition of terms, health care professionals, patients and their families-rights and obligations, truth telling and informed consent, confidentiality, guilt and innocence in treating patients, cases for study and discussion, views of the major ethical theories on bioethical issues.

Assignments/ Labs-10% Midsemester -30%End semester -60%

**ML 4105 Environmental Toxicology and Biomonitoring(Credits-02)**

Introduction to Toxicology, classification of toxic agents, toxicological information sources, types of environments and routes of exposure, risk assessment in public health, survey of toxic substances, basic techniques of biomonitoring (chemical compounds, elements and their metabolites in body fluids such as blood, urine, hair, semen, breast milk, saliva).

Assignments/ Labs-20% End semester -80%

**ML 4106 Biomaterials for Medical Devices(Credits-01)**

Introduction to Biomaterials, Implants/prostheses, Cell-material interactions, Different types of biomaterials (according to cellular responses and material composition), Different applications of biomaterials, Biocompatibility and biofunctionality, Evaluation of biocompatibility.

Assignments/ Labs-10% End semester -90%

**FOURTH YEAR SECOND SEMESTER**

**AH 4201English & Communication Skills VI (Non-credit)**

Business communication: Business letters (covering letters, resignation letters, excuse letters, request letters), Memos, Curriculum vitae, Online application forms, Personal statements. Presentation skills, Public speaking: Welcome address, Introducing a guest speaker, Vote of thanks, Job interviews.

Assignments – 40% End semester -60%

**ML 4201 Clinical Laboratory Seminars (Credits-01)**

Students are supposed to retrieve literature on given 1 clinical laboratory related scientific topic and self selected 2 topics approved by the department and collate the information into a hand written script not less than 5 pages with the given format. They are required to prepare teacher

guided power point presentations on each topic and make the presentations in front of peers and teachers. Each student is expected to question their peers on rotation basis during the discussion period.

Assignments-30% Presentations- 40%End of Semester (Written/ Essay)-30%

#### **ML 4202 Portfolio Assessment (Credits-03)**

Introductory workshop on Portfolio assessment, Gather supportive evidence and/ documents, Reflective self analysis of the available artifacts, Introduction of the selected artifacts as proof of accomplishments, Preparation of event narrative portfolio and Students are instructed to gather information at the beginning of the fourth year and required to submit the final version of the portfolio before the end of the fourth academic year.

Portfolio assessment-100%

#### **ML 4203 Procedural manual(Credits-04)**

Basic and specific laboratory procedures used in the fields of Haematotechnology, Clinical Biochemistry, Microbiology+Parasitology and Histotechnology+Cytotechnology  
Haematotechnology-25% Clinical Biochemistry -25% Microbiology+Parasitology25%  
Histotechnology+Cytotechnology-25%

#### **ML 4204 Research Project(Credits-04)**

Problem identification and project formulation, search for and retrieval of information required such as conducting literature surveys, identification and optimal utilization of available resources, project execution, socio-economic, ethical evaluation and safety evaluation when applicable, data analysis, scientific report writing and presentation.

Dissertation-50% Presentation evaluation and Defense Examination-25%  
Supervisingcommittee evaluation-25%