Vidyasagar University

Midnapore-721102, West Bengal

The SYLLABUS for

POST-GRADUATE Programme

in

BIO-MEDICAL LABORATORY SCIENCE & MANAGEMENT

Under Choice Based Credit System (CBCS)

(Semester Programme)



[w.e.f. 2022-23]

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M.Sc in Bio-Medical Laboratory Science & Management (BMLSM)

Semester	Course Code	Course Title	Full Marks	Credit (L-T-P)
I	BML-101	Clinical Laboratory Biosafety, Ethics and Total Quality Management	50	4(3-1-0)
	BML-102	Research Methodology and Medical Statistics	50	4(3-1-0)
	BML-103	Diagnostic Biochemistry	50	4(3-1-0)
	BML-104	Clinical Endocrinology	50	4(3-1-0)
	BML-195	Survey on Clinical Laboratory Biosafety, Ethics and Total Quality Management	50	4(0-0-8)
	BML-196	Research Methodology and Medical Statistics	50	4(0-0-8)
	BML-197	Diagnostic Biochemistry	50	4(0-0-8)
	BML-198	Clinical Endocrinology	50	4(0-0-8)
	TOTAL		400	32
II	BML-201	Reproductive Technology	50	4(3-1-0)
	BML-202	Clinical Haematology, Blood Bank and Blood Transfusion	50	4(3-1-0)
	BML-203	Clinical Entomology and Parasitology	50	4(3-1-0)
	BML-204	Basicof Nutritionand Health(CBCS)	50	4(3-1-0)
	BML-295	Reproductive Technology	50	4(0-0-8)
	BML-296	Clinical Haematology, Blood Bank and Blood Transfusion	50	4(0-0-8)
	BML-297	Clinical Entomology and Parasitology	50	4(0-0-8)
	BML-298	Higher Diagnostic/ Research Laboratory Visit	50	4(0-0-8)
	TOTAL		400	32
III	BML-301	Clinical Immunology and Serology	50	4(3-1-0)
	BML-302	Diagnostic Microbiology I-Bacteriology	50	4(3-1-0)
	BML-303	Diagnostic Histotechnology & Cytotechnology	50	4(3-1-0)
	BML-304	Foods Medicine & Disease Prevention(CBCS)	50	4(3-1-0)
	BML-395	Clinical Immunology and Serology	50	4(0-0-8)
	BML-396	Diagnostic Bacteriology	50	4(0-0-8)
	BML-397	Diagnostic Histotechnology & Cytotechnology	50	2(0-0-4)
	BML-398	Term Paper on Sem.-I,II & III	50	4(0-0-8)
	TOTAL		400	32
IV	BML-401	Advance Technique on Laboratory Science	50	4(3-1-0)
	BML-402	Clinical research & health informatics	50	4(3-1-0)
	BML-403	Clinical Pathology and Forensic Science	50	4(3-1-0)
	BML-404	Diagnostic Microbiology-Ii-Virology & Mycology	50	4(3-1-0)
	BML-495	Clinical Pathology	50	4(0-0-8)
	BML-496	Diagnostic Microbiology-Ii-Virology & Mycology	50	4(0-0-8)
	BML-497	Internship	100	8(0-0-16)
	TOTAL		400	32
	GRANDTOTAL		1600	128

The total credit for the course is 128.

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Distinctive Features of the Courses:

		Course code
1.	Value-added course:	BML-102, BML-201, BML-203, BML-301, BML-302, BML-304, BML-403
2.	Employability:	BML-103, BML-104, BML- 197, BML-202, BML-296, BML-395
3.	Entrepreneurship:	BML-103, BML-395, BML-396, BML-397, BML-497
4.	Skill development:	BML- 198, BML-295, BML-298, BML-303 BML-396, BML-397, BML-495, BML-497
5.	Digital content:	BML-401
6.	Ethics:	BML- 101, BML-195
7.	Human values:	BML-297
8.	Environment & sustainability:	BML-196, BML- 101, BML-195
9.	The new course introduced:	BML-402, BML-404, BML-496

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SEMESTER-I

Paper: BML 101: Clinical Laboratory Biosafety, Ethics & Total Quality Management **Full Marks: 50 Credit: 4**

Course outcome:

- To upgrade the knowledge about the mode of infectious of biological samples/agents to protect the health professionals engaged in diagnostic laboratories.

- To take measure about the pathogens present in biological sample for environment contamination.

- To unfold the impact of human values in laboratory medicine.

- To motivate the manpower in this field to be accountable to their respective assignment.

- To focus the way of quality empowerment on laboratory diagnostic output.

- To teach the health professions about good laboratory practices for quality enhancement in laboratory medicine.

Various types of laboratories. Code of good and safe laboratory practice for support staff and responsibilities of the workers regarding Bio-safety. Set up of a laboratory on the basis of safety priority and Laboratory Biosafety Guidelines. Laboratory Biosafety Level Criteria (BSL-1-4) for better microbiological laboratory practices. Handling, transfer and shipment of specimen. Decontamination and disposal. Treatment and disposal technologies for health- care waste. Wastes management. Reduce recycle and reuse of wastes. Various Laboratory hazards and preventive measures. Chemical, electrical, fire and radiation safety. Safety organization. General Safety checklist. Laboratory first-aid measures and kit. Safety equipment. Safety signs and signage system in laboratory and hospital.

General Ethical views. Co-operation and working relationship with other health professionals. Confidentiality of patient information and test result. Dignity and privacy of patient. Responsibility from acquisition of the specimen to the production of data. Accountability for quality and integrity of clinical laboratory services. Institutional ethical committee and its role. Role of Animal and Human ethical committee and its criteria of approval. Health & Medical surveillance. Laboratory ethics of biosafety.

Quality Control of the product, chemicals, reagent. Total quality management framework of laboratory. Essential elements of Quality Assurance Programme. Internal and external factors for quality control assurance. Internal Quality control: control of pre-analytical variables, control of analytical variables, laboratory precision, accuracy & sensitivity, validation of methods. Reference materials and calibrating definitive methods. Sources of variation in laboratory test results. Types of Laboratory Errors. Quality control charts: Levy-Jenning chart, Cusum chart and Gaussian curve, Westgard rule. Reference

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value. Standard Bio- Medical Laboratory set up as per working criteria. External quality control. Management to the client, patient, physician, administrative authority. Cost of conformance & non- conformance. Good laboratory management practices.

Paper: BML 102: Research Methodology & Medical Statistics Full Marks: 50 Credit: 4

Course outcome:

To highlight the importance of data analysis in computer using statistical software in laboratory medicine.

Basic, action and action research; qualitative & quantitative research, experimental and quasi-experimental research, research hypothesis, sampling & types, research project formulation & research report writing, quality of report writing.

Medical statistics: mean, median, mode, SD, SEM, probability, t-test, null hypothesis, co-relation, chi- square, ANOVA, F-test, regression, post-hoc analysis. Selection of appropriate methods for statistical analysis of collected parameters of biological samples. Haematological mathematics. Enzymatic calculation- Mathematical approach.

Paper: BML 103: Diagnostic Biochemistry

Full Marks: 50 Credit: 4

Course outcome:

- To equip the knowledge on chemical analysis of body fluids for diagnostic and therapeutic purpose.

Biochemical changes in the body under pathological condition. Specimen processing for biochemical analysis. Preparation of serum specimen for biochemical analysis. Preparation of protein free filtrate. Processing for urine for biochemical analysis. Photometric methods for biochemical analysis. Enzymes for cardiac diseases. Routine biochemical tests. Determination blood glucose (Glucose-oxidase method). Biochemical tests for cardiac function, liver function, pancreatic function, renal function and gastric function. Determination of carbon monoxide– toxicity assessment. Screening of different drugs. Screening of heavy metals.

Paper: BML 104: Clinical Endocrinology **Full Marks: 50 Credit: 4**

Course outcome:

- To reflect the role of chemical coordinating system for maintains health status.
- To equip the student about deviation of endocrine system in relation to heal diseases.

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Endocrine glands (male and female) and endocrinal dysfunctions. Hormones assay and different types of standard curve used in immunoassay. Different types of ELISA and steps for antibody coating, enzyme conjugate preparation, second antibody preparation. Testing of hormone by ELISA. Chemiluminescence's assay, Electrochemoluminance, Fluorescence Immunoassay (FIA). Intra-assay and inter- assay co-efficient of hormones assay. Sensitivity and cross-reaction specificity. Standard curve plotting. Interpretation. Different steps of RIA. Assay of hormone by RIA. Radio labelling of hormones. Recording of results and Interpretation.

Paper: BML 195: Survey on Clinical Laboratory Biosafety, Ethics & Total Quality Management

Full Marks: 50 Credit: 4

Course outcome:

- To train up the students to minimize the way of infection during handling of infectious biological sample.
- To focus the association between quality reagents and equipment with quality results outcome.

Paper: BML 196: Research Methodology & Medical Statistics

Full Marks: 50 Credit: 4

Course outcome:

Assignment of research report writing

Problems on statistics: central tendencies, prediction statistics, co-relation, dispersion, ANOVA, F-test.

Paper: BML 197: Diagnostic Biochemistry **Full Marks: 50 Credit: 4**

Course outcome:

Preparation of plasma and serum for biochemical analysis, preparation of protein free filtrate from blood. Determination of blood glucose (glucose oxidase method).Determination of total protein in serum (Biuret method). Determination of serum albumin/globulin. Determination of blood urea (Oxime method) and by kit method. Determination of creatinine in blood serum (Alkaline picrate method & by using kit). d. Determination of uric acid in serum by phosphatungstate method and by using kit. Determination of serum bilirubin by colorimetric method and by using

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kit. Determination of serum triglyceride by colorimetric method and by using kit. Determination of blood cholesterol by colorimetric method and by kit method. Determination of phospholipids, LDL, VLDL by using kit and, HDL. Determination of serum Ca^{+1}, Na^{+}, K^{+}, &Cl^{-} by biochemical method,$^{-}$ HCO3. Determination of SGOT, SGPT, serum ACP, ALP, LDH, amylase and CPK by using kits and biochemical methods. Experiments on glucose tolerance test. Alcohol, methanol, acetone screening and drug screening in blood by biochemical method (as per theory).Measurement of glycosylated haemoglobine (colorimetric method). Measurement of γ-GT level. Special tests for different types of Liver diseases, renal diseases, gastric disorders and pancreatic disorders. Test for renal prostate specific antigen, acid phosphatase (prostatic fraction) and alkaline phosphatase. Blood level of Hg, As, Fl, Pb and Li. Determination of carbon monoxide. Screening of few drugs.

Paper: BML 198: Clinical Endocrinology **Full Marks: 50 Credit: 4**

Course outcome:

•To familiar about the quantification hormones in biological samples and its accuracy assessment.

Instrument used in hormone assay. Programme in ELISA reader for hormone assay. Intra assay & Inter assay variation & cross reaction in hormone assay. Standard curve plotting. Assay of FSH, TSH, LH, GH, Insulin in ELISA. Assay of T3 andT4 in ELISA reader. Assay of Testosterone, E2, Progesterone in ELISA reader Interpretation of results of LH, FSH, testosterone, estradiol and PRL from same serum sample(As per sex). Interpretation of results of TSH and T3 / T4 from same serum sample. Quantification of blood iodine for the assessment of thyroid. Interpretation of results of insulin and C-peptide from same serum sample. Interpretation of results of ACTH and cortisol from same serum sample.

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SEMESTER-II

Paper: BML 201: Reproductive Technology

Full Marks: 50 Credit: 4

Course outcome:

- To aware the targets about the infertility management and modern technique adopted in health sector for such management.

- To focus the methods adopted for quality grade sperm and oocyte collection followed by in-vitro fertilization.

Spermatogenesis. Qualitative and quantitative study of spermatogenesis. Hormonal control of spermatogenesis. Method of semen collection and physical, microscopic and biochemical examination semen, sperm count, sperm motility, sperm morphology, fructose estimation of semen, acid phosphatase of semen. Hypoosmolarity test of sperm. Oogenesis, Ovulation and its hormonal control. Cycle abnormalities. Implantation and its molecular aspect, role of blastocyst in implantation, disorder in implantation. Contraceptives: General, immunological and emergency contraceptives. Gamet bank and cryopreservation Superovulation techniques. Endometriosis. Sperm viability. Testing for antibody coating of spermatozoa, cervical mucus Interaction capillary tube test, Leukocyte count in semen. Acrosome testing. Detection of rape by police department-acid phosphatase study. Different techniques used in infertility clinic with special reference to assisted reproductive technology (ART).

Paper: BML 202: Clinical Haematology, Blood Bank and Blood Transfusion

Full Marks: 50 Credit: 4

Course outcome:

- Students are highlighted with haematological sensors in association with different diseases.

- Learners are equipped with modern knowledge about blood fractionation and transformation of specific fraction as per conditions demand.

Introduction to haematology. Components of blood– Cellular part & acellular part, erythropoiesis, leucopoiesis & thrombocytosis. Basic mechanism of blood coagulation. Hemoglobin – chemistry. Types of Hemoglobin, and hemoglobin and its measurement. Blood collection. Anticoagulant used in laboratories. Automation in haematology. Routine hematological tests and Bleeding disorders &Important routine coagulation test. Special hematological tests and test for blood coagulation. Haemoglobinopathies and blood cancer. Haemolytic diseases of the newborn. Idea about thalasemia and sickle cell anemia. Basic

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concept and principles of immunohae matology and blood transfusion. Antigens and antibodies in blood. Blood group and testing, H antigen, Rh- typing, MN group, sub types. Disorder due to mismatched blood transfusion and Erythroblastosisfoetails. Transmission of diseases in relation to blood transfusion. Blood banking and blood bank techniques.

Paper: BML 203: Clinical Entomology and Parasitology

Full Marks: 50 Credit: 4

Course outcome:

- To train the student about different parasites along with their identification feature.

Collection, handling and processing of faecal specimens. Laboratory techniques in parasitological investigation of stool & Occult blood test. Lab Records and Reporting of results of stool examination. Sending of faecal specimen for referral services. Staining of faecal smears and blood films. Processing of specimens other than stools i.e. sputum, urine, urogenital swab. Laboratory identifications of human parasites (protozoa, helminthes).Techniques for the measurements of the size of parasite eggs. Morphological characters of common parasitic protozoa. Identifying characters of various helminthes. Laboratory diagnosis of Filaria infections, blood fluke infections and trichomoniasis.

Paper: BML 204: Basic Nutritionand Health (CBCS) Full Marks: 50 Credit: 4

Introduction to nutrition:

Food as source of nutrients, functions of food, definition of nutrition and health, nutrients & energy, adequate, optimum & good nutrition, malnutrition. Basic five food groups How to use food guide (according to R.D.A.)

Nutrition and fitness:

Interrelationship between nutrition & health

Use of carbohydrate, protein and fat, minerals and vitamins from food sources and its significances.

Role of dietary fibres in human nutrition.

Effect of cooking on the nutritive value and Food sanitation in hygiene.

Paper: BML 295: Reproductive Technology Full Marks: 50 Credit: 4

Course outcome:

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- To train up the students about processing of semen for collection of high-quality sperm to manage infertility.

Sperm count in ejaculated semen and quality assessment. Sperm motility & viability test. Sperm nuclear chromatin decondensation test. Hypoosmotic swelling test.Anti sperm antibody testing. Sperm mitochondrial activity index test. Sperm membrane enzyme testing. Ovulation determination by oral body temperature and graphical representation. Quantification of hCG (Medico legal aspects). Acrosomal status evaluation.EC50 determination of spermicidal agent.Fertility power of sperm (Acrosome testing).Collection of super grade quality of sperm for ART. Biochemical antioxidant enzyme assay of sperm pellet. Biochemical assay of Glutathione-S-transferase of sperm pellet. Biochemical assay of free radicals in sperm pellet. Fructose determination in semen. Acid phosphatase in semen. Rapetest.

Paper: BML 296: Clinical Haematology, Blood Bank and Blood Transfusion

Full Marks: 50 Credit: 4

Course outcome:

- To handle the blood sample for quality grade assessments of haematology based sensors in connection with disease diagnosis.

Blood film preparation & its staining, identification of different types of leucocytes. Collection of blood samples from vein. Complete hemogram. Quantification of reticulocytes and thrombocytes. Determination of clotting time and bleeding time, Determination of clot retraction, prothrombin time, thrombin time and lyses time Determination of APTT, PTT. Demonstration of automatic analyser. Determination of G-6-PD. Detection of iron in prepared smear. Determination of iron and total iron binding capacity (TIBC) in serum. Haemoglobin electrophoresis (Demonstration) including glycosylated Hb. Preparation of bone marrow smear and its staining and identification of mega karyocytes. Plasma recalcification time, Determination of fibrinogen, Protamine sulphate test. Leukaemia and Sickle cell anemia detection. T-cell, B-cell preparation. Red cell pyruvate kinase assay. Naked Eye Single Tube Red Cell Osmotic Fragility test (NESTRO F test), Acidified serum test and sucrose lysis test.

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Blood grouping and Rh typing. Reagent preparation of blood banking and demonstration of blood bank. Detection of Thalassemia by paper electrophoresis/ Hb-s Osmotic fragility test. Giemsa stain of blood films (thick and thin) for detection of malarial parasite. Preparation of packed red cells. Cross matchingtestinbloodblank:salinetube&Coomb'scrossmatching.Compatibilitytest bysalinetube method. Qualitative test for the recognition of Rho antigen on human RBC and determination of Rho typing by slide method. Serum grouping test. Coomb's direct & indirect test in blood blank. Quantitative determination of anti-D antibody titer.

Paper: BML 297: Clinical Entomology and Parasitology Full Marks: 50 Credit: 4

Course outcome:

Paper: BML 298: Higher Diagnostic/ Research Laboratory Visit

Full Marks: 50 Credit: 4

Course outcome:

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SEMESTER-III

Paper: BML 301: Clinical Immunology and Serology **Full Marks: 50 Credit: 4**

Course outcome:

- To study the disease caused by disorders of the immune system and the sero-diagnosis of that immune-disorders.

Principle of immunological reaction. Immunotechniques. Principles of sero-diagnostic test. Laboratory procedures in serology. Hypersensitivity reactions, and immunosupression. Vaccination-schedule, Transplantational immunology. Immunology of tumor formation. Hybridoma technology. Different Serological screening and confirmative test for different infectious diseases.

Paper: BML 302: Diagnostic Microbiology I-Bacteriology **Full Marks: 50 Credit: 4**

Course outcome:

•To avoid knowledge on prevention, diagnosis and treatment of infectious disease for the improvement of health.

Introduction: Microbes in history; general principles in clinical microbiology; microbial structure, taxonomy; human microbiome in health and disease, host microbe interactions; microbial growth; physical and chemical control measures (infection control).

Laboratory tools for characterization of microbes: Methods of microbial investigation; clinical specimen collection for microbiological processing, microscopy, staining techniques, microbiological media and culture techniques, biochemical tests for identification.

Bacterial diseases: Mechanisms of bacterial pathogenesis; role of bacteria in disease, nosocomial infections, epidemiology of bacterial diseases; bacterial diseases of skin (Staphylococcal & Streptococcal infections), eyes (ophthalmianeonatorum, conjunctivitis, trachoma), nervous system (meningitis, tetanus, botulism, leprosy), cardiovascular and lymphatic systems (sepsis & septic shock, endocarditis, rheumatic fever, tularemia, brucellosis, anthrax, gangrene, plague, typhus fever), respiratory system (strep throat, scarlet fever, diphtheria, otits media, pertussis, tuberculosis, pneumonia), digestive system (periodontal disease, staphylococcal enterotoxicosis, shigellosis, gastroenteritis, cholera, typhoid fever, peptic ulcer, CDAD), urinary system (cystitis, pyelonephritis, leptospirosis) and reproductive system (gonorrhea, urethritis, PID, syphilis, LGV, chancroid, vaginosis).

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Antibiotics: History of chemotherapy, spectrum of antimicrobial activity, survey of major antimicrobial drug groups, mode of antibiotic action, interactions between drugs and microbes, interactions between drugs and hosts, antimicrobial susceptibility testing to guide chemotherapy, antibiotic safety, effects of combinations of drugs.

Paper: BML 303: Diagnostic Histotechnology & Cytotechnology

Full Marks: 50 Credit: 4

Course outcome:

- To update the concept of microscopic examination of human cell and whole tissue, sample, immunohistochemistry and marker detection of biopsy sample.

Laboratory equipments for cytology. Vacuum embedding bath, automated tissue processor. Specimen preparation in cytotechnology. Stains & staining technique in cytology. Manual components for tissue staining and automated tissue stainer.

Process of collection, fixative, Errors of cytology, PAP stain. Hazards in cytology Lab. Immunofluorescence Cytotechnology. Laboratory equipments for histology. Section cutting and its technique. Fixatives, Dehydration, Clearing agents, Embedding –Technique of section cutting, problems in section cutting, preparation of histological slide and mounting. Use of different staining procedure for confirmation of pathological condition.

Paper: BML 304: Foods Medicine & Disease Prevention (CBCS)

Full Marks: 50 Credit: 4

Concept of disease- communicable and non-communicable disease, life style disorder. Very basic concept of medicine.

Culture of health and wellness and healthy food. Supplementary and fortified food. Fast food and junk food culture and its related hazards. Practice of healthy food habit from infancy, Food for common disorders-fever, gastritis, diarrhea, IBS, colitis.

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Food for lifestyle disorder-stress and anxiety, obesity, diabetes, hypertension and cardiovascular disorders, renal disorders, asthma, COPD.

Paper: BML 395: Clinical Immunology and Serology Full Marks: 50 Credit: 4

Course outcome:

- To train the students about different conventional and advanced methods for screening the marker as pathogen of various disease.

Precipitation, agglutination and coagulation. Qualitative indirect enzyme immunoassay for the detection of serum antinuclear antibodies. Tumor markers, Cancer markers: CEA-α- fetoprotein, CA-125, CA-19, CA-15, PAS-Free / Total. Immunoturbidometric analysis of biomolecules. RPR and titer estimation WIDAL test and titer estimation, ASO test and titer estimation, RA test and CRP test and titer estimation, HIV test and Hepatitis profile. TORCH panel. Dengue & Lupus erythemetosus. *Helicobacter pylori* and titer estimation. *Mycobacterium tuberculosis*. Montouxtest.

Paper: BML 396: Diagnostic Bacteriology Full Marks: 50 Credit: 4

Course outcome:

- To train the students about different conventional and advanced methods for screening the marker as pathogen of various disease.

Preparation of culture media and reagents, sterilization, aseptic practices in laboratory and safety precautions, quality control of media, reagents etc. and validation of sterilization procedures, collection of clinical samples for microbiological processing, culture techniques, semi-quantitative analysis of urine by standard loop test for significant bacteriuria, sputum culture, blood culture, Gram stain, AFB stain, Albert stain, capsule stain, endospore stain, different biochemical tests for bacterial identification, antimicrobial susceptibility testing by disc diffusion and MIC, MBC, antibiogram, disposal of contaminated materials, biological spill management, maintenance of stock cultures, case study of bacterial infections, identification of bacterial pathogens by PCR.

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Paper: BML 397: Diagnostic Histotechnology & Cytotechnology

Full Marks: 50 Credit: 4

Course outcome:

- To build the hands on experience of examining different tissue samples and smears.)

Cytological fixatives and stain and their preparation. Preparation of given percentage of alcohol from commercially available ethyl alcohol. Preparation of specimen for cytological evaluation, processing. Fixation staining, papanicolaon staining techniques, Crystal violetstaining. Sex chromosome study. Identifying characteristics of benign and malignantcells. Fixation of tissue –Preparation of different fixative. Sharpening ofthe microtome knife. Decalcification of calcified tissue. Dehydration of tissue-preparation of gradedalcohol- clearing of fixed tissue, and embedding-paraffin block preparation /gelatin, cellodin water soluble wax. Section cutting in microtome and freezedrying techniques for section cutting in cryocut. Stain preparation- haematoxylin, types, eosin, trichrome stain, phosphotungstic acid, iron haematoxyleane, PAS stain, Prussian blue stain, gram staining, acid fast staining, sudden-III and IV stain. VanuGisen stain, Pearl stain (for FC), Purpurin / Vonkosa stain(Bone in tissue calcification), Reticulin. Staining techniques using above stains.Immunohisto technology. Immuno fluorescencehisto technology.

Paper: BML 398: Term Paper on Sem.-I, II & III Full Marks: 50 Credit: 4

Course outcome:

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SEMESTER-IV

Paper: BML 401: Advance Technique on Laboratory Science

Full Marks: 50 Credit: 4

Course outcome:

- To expose the modern technologies adopted for confirmation of diagnosis by using molecular technologies.

PhysiologicalbasisofECG&EEG.RecordingmethodfollowedinECGandEEG.Basi cprincipleof Centrifuge (ordinary, ultra and cold). Basic principle

OfSemi auto/autoanalyzer, spectrofluorometer, flame photometer, luminometer, Sonicator, Lyophilizer. ELISA reader, Flow cytometryandAutoanalyser-basicprinciple,protocoloftheiruseandtheirapplicationinbio-medical science. Fundamentals of emerging technologies in medical sciences-Melanoma Biopsies, Electronic Aspirin, Robotic Check-Ups, Stem Cell and Organ Therapy. PCR in diagnosis of diseases. Southern, Northern and Western Blot in diagnostic field. Mass Spectrometry- Principle, procedure and application for diagnosis of diseases. Modern techniques for laboratory diagnosis of pathogenic bacteria-mycobacterial, Genomics, transcriptomics, proteomics and metabolomics - Principle and application for diagnosis of various diseases; Identification uncultured pathogens; DNA and Protein gel electrophoresis. Separation Methods -An introduction to chromatographic separation, paper chromatography, TLC, Gas Chromatography, High Pressure Liquid Chromatography, UPLC and FPLC.Clinical applications of molecular biology for infectious diseases-immunological, biochemical, electronmicroscopy.

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Paper: BML 402: Clinical Research & Health Informatics Full Marks: 50 Credit: 4

Course outcome:

- To familiar the students about the step considered for establishing a promising agent as drug and for patenting the new products/ process etc.

Basics of Clinical Research. Basic terminology used in clinical research. New drug discovery process Pre-clinical toxicology: Carcinogenicity, Mutagenicity, Teratogenicity, Single dose and repeat dose toxicity studies, toxicological principles, Reproductive toxicity. Pharmacokinetics. Biopharmaceutics Types of clinical trials, Design and organization of phase-I, phase-II, phase-III, phase-IV trials. Various regulatory requirements in clinical trials. Schedule Y, ICMR guidelines etc. Pre and post drug approval. Drug Regulatory Authorities- USFDA, EU, DCGI, ICMR, ICH-GCP, SCHEDULE-Y, IPR, HIPPA, Patent IND, NDA- Sbubmission forms, submission process. Inspection and Audits- Regulatory Overview. Ethics Committee, IRB, DSMB. Pharmacovigilience- AE, SAE, ADR**. Introduction of bioinformatics**-Definition of database, types, biological database, computer languages for bioinformatics, application of bioinformatics, bioinformatics resources –NCBI, EBI, PubMed, BioMed Central, Basic concept of sequence similarity, identity, and homology. Genome analysis, Phylogenetic tree, Motif analysis

Paper: BML 403: Clinical Pathology and Forensic Science

Full Marks: 50 Credit: 4

Course outcome:

•To investigate the root cause analysis of disease through examination of organs, tissues, body fluids as well as different biological samples.

Biochemical analysis of urine. Routine examination of urine- physical, microscopic examination of urine specimen. Routine examination of stool. Chemical test of urine. Laboratory examination of miscellaneous bodyfluids. Collection, handling

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and transfer of sputum, swab and stool.

Routine and Microscopic examination of sputum. Examination of urogenital swab, rectal swab, throat and mouth specimen, pus from wounds, ear discharge. abscesses, burns and sinuses, skin exudates from syphilispatient.

Paper: BML 404: Diagnostic Microbiology II-Virology & Mycology

Full Marks: 50 Credit: 4

Course outcome:

- To avoid knowledge on prevention, diagnosis and treatment of infectious disease for the improvement of health.

Mycology
Introduction: History of medical mycology; taxonomy and classification of medically important fungi; general characteristics and reproduction of pathogenic fungi.

Fungal diseases: Pathogenesis of fungal disease; role of fungi in disease; superficial mycoses (pityriasis), cutaneous mycoses (dermatophytoses), subcutaneous mycoses (sporotrichosis, chromoblastomycosis, mycetoma, phaeohyphomycoses), systemic mycoses (histoplasmosis, coccidioidomycosis, blastomycosis, talaromycosis), opportunistic mycoses (candidiasis, aspergillosis, cryptococcosis, mucormycoses, pneumocystosis)

Laboratory diagnosis: Staining and direct microscopy; macroscopic characterization by fungal culture; biosensors for direct detection of invasive mycoses.

Antifungal agents: Mode of actions of major antifungal drugs; systemic and topical antifungal drugs; combination antifungal therapy; antifungal resistance.

Virology
Introduction: History of medical virology; taxonomy and classification of medically important viruses; general characteristics of viruses, viral structure and propagation.

Viral diseases: Mechanisms of viral pathogenesis; role of viruses in disease; viral diseases of skin (warts, smallpox, chickenpox, herpes simplex, measles, rubella), nervous system (poliomyelitis, rabies), cardiovascular and lymphatic systems (Burkitt's lymphoma, mononucleosis, CMV infections, chikungunya, viral hemorrhagic fevers), respiratory system (common cold, pneumonia, RSV, flu), digestive system (mumps, hepatitis, gastroenteritis), reproductive system (genital herpes, warts, AIDS);prion diseases

Laboratory diagnosis: Cytology, electron microscopy; viral isolation & growth; detection of viral genes & proteins; viral serology.

Antiviral agents: Mode of action of antivirals; nucleoside analogs, non-nucleoside polymerase inhibitors, protease inhibitors, anti-influenza drugs

Paper: BML 495: Clinical Pathology **Full Marks: 50 Credit: 4**

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Course outcome:

- To build the hands on experience of examining different tissue samples and smears.

Measurement of glycosylated haemoglobine (colorimetric method). Measurement of γ-GT level. Special tests for different types of Liver diseases, renal diseases, gastric disorders and pancreatic disorders. Test for renal prostate specific antigen, acid phosphatase (prostatic fraction) and alkaline phosphatase. Blood level of Hg, As, Fl, Pb and Li. Determination of carbon monoxide. Screening of few drugs.

Paper: BML 496: Diagnostic Microbiology II-Virology & Mycology

Full Marks: 50 Credit: 4

Course outcome:

- To train the students about different conventional and advanced methods for screening the marker as pathogen of various disease.

Use of different fungal culture media, microscopic identification of fungi by India Ink preparation, KOH preparation, Gram stain, lactophenol cotton blue stain, macroscopic identification of fungi by culture, antifungal susceptibility testing, case study of mycoses

Demonstration of cell culture laboratories, detection of measles, dengue, HBV, HCV and HIV by ELISA, application of PCR in detection of different viral infections, case study of viral infections

Paper: BML 497: Internship **Full Marks: 100 Credit: 8**

Course outcome:

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