

VIDYASAGAR UNIVERSITY  
MIDNAPORE-721102



The SYLLABUS for POST- GRADUATE Courses

in

**Biomedical Laboratory Science and  
Management**

*Revised Syllabus (New CGPA  
Semester System)*

[w. e. f. 2018-19 session]

## **Program Outcome**

The Masters of Science (M.Sc) in Bio-Medical Laboratory Science & Management is an interdisciplinary two-year course exploring the science of diagnosis about human health and its related diseases. The purpose of this course is to equip professional expertise in biomedical laboratory science and technology across the biological and medical vocations for providing potent and reliable laboratory-based information, knowledge and skills. This information is very crucial for practice of biomedical science affecting the public such as diagnosis, therapy, research and policy issues. This course is also a career ladder for future scientists providing scientific proficiency and rigidity to accept the upcoming challenges.

## M.Sc. in BIOMEDICAL LABORATORY SCIENCE & MANAGEMENT

SEMESTER	COURSE NO.	COURSE TITLES	Full Marks	Credit
I	BML 101	LABORATORY BIO-SAFETY	50	4
	BML 102	TOTAL QUALITY MANAGEMENT	50	4
	BML 103	LABORATORY ETHICS	50	4
	BML 104	PATHOPHYSIOLOGY OF ENDOCRINE SYSTEM	50	4
	BML 194	SURVEY ON LABORATORY BIO-SAFETY AND TOTAL QUALITY MANAGEMENT (practical)	50	4
	BML 195	HORMONE ASSAY TECHNIQUES AND SURVEY ON LABORATORY ETHICS	50	4
	TOTAL		300	24
II	BML 201	REPRODUCTIVE EVENTS AND ASSISTED REPRODUCTIVE TECHNOLOGY	50	4
	BML 202	HAEMATOLOGY AND TRANSFUSION SCIENCE	50	4
	BML 203	COMPUTER APPLICATIONS AND BIO-STATISTICS	50	4
	C-BML 204	BASIC OF NUTRITION AND HEALTH(CBCS)	50	4
	BML 295	ASSISTED REPRODUCTIVE TECHNOLOGY AND MEDICAL STATISTICS	50	4
	BML 296	HAEMATOLOGY AND COMPUTER APPLICATION	50	4
	TOTAL		300	24
III	BML 301	CLINICAL IMMUNOLOGY, SEROLOGY AND MICROBIOLOGY	50	4
	BML 302	CYTOTECHNOLOGY, HISTOTECHNOLOGY AND PARASITOLOGY	50	4
	BML 303	CLINICAL BIOCHEMISTRY AND PATHOLOGY	50	4
	C-BML 304	FOOD AS MEDICINE AND PREVENTION OF DISEASES (CBCS)	50	4
	BML 395	IMMUNOLOGY, SEROLOGY AND MICROBIOLOGY	50	4
	BML 396	HISTOTECHNOLOGY, CLINICAL BIOCHEMISTRY AND PATHOLOGY	50	2
	TOTAL		300	24
IV	BML 401	ADVANCE TECHNIQUES IN LABORATORY SCIENCE	50	4
	BML 402	CLINICAL RESEARCH AND BIO-INFORMATICS	50	4
	BML 493	INTERNSHIP	200	16
	TOTAL		300	24
	GRAND TOTAL		1200	96

**Vidyasagar University**  
**M. Sc.**  
**Biomedical Laboratory Science and Management**  
**Revised syllabus (New CGPA semester pattern) (w.e.f. June, 2018)**

**Title of the Course: M.Sc.- Biomedical Laboratory Science and**

**Management Introduction:** This course provides a broad overview of Laboratory medicine to generate expert hands that would have ample knowledge and proficiency to solve the critical problems of the region by using Biomedical Laboratory Science and Management.

The objectives of Biomedical Laboratory Science and Management are

- a) To provide a demanding and comprehensive learning to the students in field of laboratory biomedicine.
- b) The course is also envisioned to develop awareness & knowledge of advance tools used in the diagnostic field for disease detection.
- c) To train the students to take up extensive range of roles as researchers, scientists, mentors, industrialists, academicians, industry leaders and policy makers.

**Advantages of the Course:**

- The course structure is technology-centric which helps students to engage themselves in the professional field at Gov./ NGO Level at hospital, Medical & Scientific Research research institute, Paramedical / medical colleges / Universities in India & abroad, biosafety and quality control division, industry of diagnostic products. Above all this course has an opportunity of self-employment with minimum investment at initial level by developing their own lab of biomedicine.

**Duration:**

- The duration for this program is of 2 years with semester pattern(04 Semesters)

Medium of Instruction: English

**SEMESTER-I**  
**COURSE STRUCTURE**  
**(ME= Major Exam, IA= Internal**  
**Assessment)**

COURSE NO.	COURSE TITLES	ME	IA	Total	Credit
BML 101	LABORATORY BIO-SAFETY	40	10	50	4
BML 102	TOTAL QUALITY MANAGEMENT	40	10	50	4
BML 103	LABORATORY ETHICS	40	10	50	4
BML 104	PATHOPHYSIOLOGY OF ENDOCRINE SYSTEM	40	10	50	4
BML 195	SURVEY ON LABORATORY BIO-SAFETY AND TOTAL QUALITY MANAGEMENT (practical)	50	-	50	4
BML 196	HORMONE ASSAY TECHNIQUES AND SURVEY ON LABORATORY ETHICS (Practical)	50	-	50	4
<b>TOTAL</b>		<b>300</b>			<b>24</b>

**Paper: BML 101: Laboratory Bio-safety      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.

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 equipments. Safety signs and signage system in laboratory and hospital.

**Paper: BML 102: Total Quality Management****Full Marks: 50 Credit: 4****Course outcome:**

- 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.

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 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 103: Laboratory Ethics****Full Marks: 50****Credit: 4****Course outcome:**

- To unfold the impact of human values in laboratory medicine.
- To motivate the manpower in this field to be accountable to their respective assignment.

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.

**Paper: BML 104: Pathophysiology of Endocrine System and Techniques in Hormone Assay**

**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.

Endocrine glands (male and female) and endocrinal dysfunction. 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. Radiolabelling of hormones. Recording of results and Interpretation.

**Paper: BML 194: Survey on Laboratory Bio-safety and Total Quality Management Laboratory Ethics**

**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 out come.

**Paper: BML 195: Hormone Assay Techniques and Survey on Laboratory Ethics**

**Full Marks: 50      Credit: 4**

**Course outcome:**

- To familiar about the quantification hormones in biological samples and its accuracy assessment.
- To correlate the human values and collection of reliable laboratory data.

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 and T4 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.



**SEMESTER-II**  
**COURSE STRUCTURE**  
**(ME= Major Exam, IA= Internal**  
**Assessment)**

COURSE NO.	COURSE TITLES	ME	IA	Total	Credit
BML 201	REPRODUCTIVE EVENTS AND ASSISTED REPRODUCTIVE TECHNOLOGY	40	10	50	4
BML 202	HAEMATOLOGY AND TRANSFUSION SCIENCE	40	10	50	4
BML 203	COMPUTER APPLICATIONS AND BIO-STATISTICS	40	10	50	4
<i>C-BML 204</i>	<i>BASIC OF NUTRITION AND HEALTH(CBCS)</i>	40	10	50	4
BML 295	ASSISTED REPRODUCTIVE TECHNOLOGY AND MEDICAL STATISTICS (Practical)	50	-	50	4
BML 296	HAEMATOLOGY AND COMPUTER APPLICATION (Practical)	50	-	50	4
<b>TOTAL</b>		<b>300</b>			<b>24</b>

**Paper: BML 201: Reproductive Events and Assisted 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: Haematology and Transfusion Science**

**Full Marks: 50      Credit: 4**

**Course outcome:**

- Students are highlighted with hematological 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 thalassemia and sickle cell anemia.

Basic concept and principles of immunohaematology 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 Erythroblastosis foetals. Transmission of diseases in relation to blood transfusion. Blood banking and blood bank techniques.

## **Paper: BML 203: Computer Applications and Bio- Statistics**

**Full Marks: 50      Credit: 4**

### **Course outcome:**

- To highlight the importance of data analysis in computer using statistical software in laboratory medicine.
- To familiar the student about biological data bank generation and its preservation in computer for future purpose.

Medical statistics: mean, median, mode, SD, SEM, probability, t-test, null hypothesis, correlation, chi- square, ANOVA, posthoc analysis. Selection of appropriate methods for statistical analysis of collected parameters of biological samples. Haematological mathematics. Enzymatic calculation- Mathematical approach. Basic idea of computer- Computer Hardware, Software, Operating system, Computer operation

Basic idea about MS Word & MS Excel MS Power Point. Clinical data analysis, presentation through computer. Use of software for cell count, cell diameter measurement. photomicrograph system. Statistical analysis of data in computer using software. Use of internet in Bio-medical Laboratory Science. Common trouble shooting during computer operation.

## **Paper: C-BML 204: BASIC NUTRITION AND HEALTH (CBCS)**

**Full Marks: 50      Credit: 4**

### **Course outcome:**

Students will get basic idea about food and nutrition as well as the concept of hygienic food and role of nutrients on fitness.

### ***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: Assisted Reproductive Technology and Medical Statistics (Practical)**

**Full Marks: 50      Credit: 4**

**Course outcome:**

- To train up the students about processing of semen for collection of high quality sperm to manage infertility.
- To familiar the students about application of different statistical test for parametric and nonparametric variables.

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. Rape-test.

Slope determination of a standard curve. Heamatology mathematics on the basis of collected data. Use of 2 cycle, 2-3 cycles, 2-4 cycles log and semi log gap papers. Application of mathematics in gastric acid measurement, renal function test, liver function test, determination HOMA and insulin resistance Application of statistics in Bio-Medical Science for test of significance by student 't' test. Application of statistics in Bio-Medical Science for test of significance by ANOVA. Application of statistics in Bio-Medical Science for test of co-relation.

**Paper: BML 296: Haematology and Computer Application (Practical)**

**Full Marks: 50**

**Credit: 4**

**Course outcome:**

- To handle the blood sample for quality grade assessments of hematology based sensors in connection with disease diagnosis.
- To enhance the skill of the students to modern software package for Biomedical data analysis in computer.

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 analyzer,. Determination of G-6-PD. Detection of iron in prepared smear. Determination of iron and total iron binding capacity (TIBC) in serum. Hemoglobin 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. Leukemia and Sickle cell anemia detection. T-cell, B-cell preparation. Red cell pyruvate kinase assay. Naked Eye Single Tube Red Cell Osmotic Fragility test (NESTROF test), Acidified serum test and sucrose lysis test.

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 matching test in blood blank: saline tube & Coomb's cross matching. Compatibility test by saline tube 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.

Use of operating system-different commands. MS-Word- use in report writing, tabulation

of clinical data. MS-Excel- Data storage, analysis, presentation of data through bar diagram. MS-Power Point- Seminar presentation. Computer graphics using laboratory data. Cell number count, cell size measurement in a specific field by using soft ware in computer. Use of Statistical package (STATISTICA, SPSS, ORIGIN, SIGMA PLOTTER etc.) in computer. Use of software for cell count, cell diameter measurement. Use of software for computerized photomicrograph system. Use of software for UV-spectrophotometer.

**SEMESTER-III**  
**COURSE STRUCTURE**  
**(ME= Major Exam, IA= Internal**  
**Assessment)**

COURSE NO.	COURSE TITLES	ME	IA	Total	Credit
BML 301	CLINICAL IMMUNOLOGY, SEROLOGY AND MICROBIOLOGY	40	10	50	4
BML 302	CYTOTECHNOLOGY, HISTOTECHNOLOGY AND PARASITOLOGY	40	10	50	4
BML 303	CLINICAL BIOCHEMISTRY AND PATHOLOGY	40	10	50	4
C-BML 304	<i>FOOD AS MEDICINE AND PREVENTION OF DISEASES (CBCS)</i>	40	10	50	4
BML 395	IMMUNOLOGY, SEROLOGY AND MICROBIOLOGY	50	-	50	4
BML 396	HISTOTECHNOLOGY, CLINICAL BIOCHEMISTRY AND PATHOLOGY	50	-	50	4
<b>TOTAL</b>		<b>300</b>			<b>24</b>

**Paper : BML 301: Clinical Immunology, Serology and Microbiology**  
**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.
- To avoid knowledge on prevention, diagnosis and treatment of infectious disease for the improvement of health.

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

Introduction to parasitic fungi – different types of fungi with morphology. Staining procedure. Specimen collection for the study of parasitic fungi. Culture media for mycotic agents. Skin scrapping, nails, hair, sputum, pus, exudates, CSF. Laboratory

diagnosis of mycotic infection. Specimen collection and handling. Laboratory records & reporting of results. Morphological study, Staining procedure-gram staining, Acid fast staining, Albert staining and spore staining. Biochemical test for bacterial differentiation. Preparation of culture media and types. Aseptic transfer of microbes. pathogenic bacteria. Identifying characteristics of common pathogenic bacteria and isolation. Susceptibility test. Laboratory diagnosis of *Haemophilus influenza*; Pulmonary tuberculosis; Dysentery and Diarrhoea; Cholera; Renal infection and Gonorrhoea Antibiotic sensitivity tests.

**Paper: BML 302: Cytotechnology, Histotechnology and Parasitology**

**Full Marks: 50      Credit: 4**

**Course outcome:**

- To update the concept of microscopic examination of human cell and whole tissue, sample, immuno-histochemistry and marker detection of biopsy sample.
- To train the student about different parasites along with their identification feature.

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.

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 303: Clinical Biochemistry and Pathology**

**Full Marks: 50      Credit: 4**

#### **Course outcome:**

- To equip the knowledge on chemical analysis of body fluids for diagnostic and therapeutic purpose.
- To investigate the root cause analysis of disease through examination of organs, tissues, body fluids as well as different biological samples.

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.

Normal composition of urine, types, collection and preservation of urine. 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 body fluids. Collection, handling 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 syphilis patient.

**Paper: C-BML 304: FOOD AS MEDICINE AND PREVENTION OF DISEASES (CBCS)**

**Full Marks: 50      Credit: 4**

**Course outcome:** Students will acquire a concept about healthy eating to prevent disease.

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.

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

**Paper: BML 395: Immunology, Serology, Microbiology, Parasitology, Pathology (Practical)**

**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- - fetoprotein, CA-125, CA-19, CA-15, PAS-Free / Total. Immunospectrophotometric 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 erythematosus. Helicobacter pylori and titer estimation. Mycobacterium tuberculosis. Montoux test.

Sterilization of Glass goods, culture media and other materials. Basic techniques in the preparation of culture media; primary culture and secondary culture. Aseptic transfer of microbes. Identification of number of bacteria present in a sample. Morphological study of microbes. Staining procedure-gram staining, Acid fast staining and spore staining. Biochemical test for differentiation of *E. coli*, *Klebsiella* sp, *Staphylococcus* sp, *Streptococcus* sp. Preparation of culture media for pathogenic bacteria. Antibiotic sensitivity tests. Preparation of culture media and culture techniques. Collection and handling of faecal specimens. Laboratory techniques in parasitological investigation of stool & Occult blood test. Reporting of stool examination. Staining of faecal smears and blood films. Morphological study and identifying characters of Trophozoites / Cysts of Protozoa and ova/larvae/ adult forms of pathogenic helminthes. Laboratory methods for culture of blood / urine / stool / pus / sputum / C.S.F. / other specimens. Techniques for the measurements of the size of parasite eggs. Morphological characters of common parasitic protozoa and Identifying characters of various helminthes. Laboratory diagnosis of Filaria infections, blood fluke infections and trichomoniasis. Different staining methods and sputum examination for A.F.B. Lab diagnosis of Mycotic infections including KOH preparation of skin scraping & Fungus culture. Quality control in clinical mycology. Introduction to parasitic fungi- different types of fungi. Specimen collection for the study of parasitic fungi. Culture media for mycotic agents. Staining procedure. Skin scrapping, nails, hair, sputum, pus, exudates, CSF. Laboratory diagnosis of mycotic infection. Laboratory diagnosis of dermatomycosis. Laboratory diagnosis of subcutaneous mycosis systemic mycosis.

Methodology of urine collection-separate sample and 24 hours sample. Physical examination of urine Microscopic examination of urine sediment. Urine culture and antibiotic sensitivity. Biochemical estimation of glucose in urine. Biochemical estimation of protein and ketone in urine. Biochemical estimation of bilirubin (Bile salt and boil pigment), urobilinogen in urine. Determination of Urinary haemosiderin. Laboratory testing of CSF. Laboratory testing of serous fluid. Laboratory testing of synovial fluid and gastric juice. Collection, handling and transfer of sputum, swab and stool. Routine examination of sputum. Microbiological examination of sputum. Examination of urogenital swab. Examination of throat and

mouth specimen. Examination of feces. Examination of rectal swab, pus from wounds, abscesses, burns, sinuses and ear discharge. Examination of skin exudates from syphilis patient.

**Paper : BML 396: Histotechnology, Clinical Biochemistry and Pathology**

**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 violet staining. Sex chromosome study. Identifying characteristics of benign and malignant cells.

Fixation of tissue –Preparation of different fixative. Sharpening of the microtome knife. Decalcification of calcified tissue. Dehydration of tissue-preparation of graded alcohol- clearing of fixed tissue, and embedding-paraffin block preparation /gelatin, cellodin water soluble wax. Section cutting in microtome and freeze drying 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. Vanu Gisen stain, Pearl stain(for FC), Purpurin / Vonkosa stain(Bone in tissue calcification), Reticulin. Staining techniques using above stains. Immuno histotechnology. Immuno fluorescence histotechnology.

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 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  $\text{Ca}^{+1}$ ,  $\text{Na}^{+}$ ,  $\text{K}^{+}$ , &  $\text{Cl}^{-}$  by biochemical method,  $\text{HCO}_3^{-}$ . 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  $\gamma$ -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.

**SEMESTER-IV**  
**COURSE STRUCTURE**  
**(ME= Major Exam, IA= Internal**  
**Assessment)**

COURSE NO.	COURSE TITLES	ME	IA	Total	Credit
BML 401	ADVANCE TECHNIQUES IN LABORATORY SCIENCE	40	10	50	4
BML 402	CLINICAL RESEARCH AND BIO-INFORMATICS	40	10	50	4
BML 403	INTERNSHIP	200	-	200	4
<b>TOTAL</b>		<b>300</b>			<b>24</b>

**Paper : BML 401: Advance Techniques in Laboratory Science**

**Full Marks: 50      Credit: 4**

**Course outcome:**

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

Physiological basis of ECG & EEG. Recording method followed in ECG and EEG. Basic principle of Centrifuge (ordinary, ultra and cold). Basic principle of Semi auto/auto analyzer, spectrofluorometer, flame photometer, luminometer, Sonicator, Lyophilizer. ELISA reader, Flow cytometry and Autoanalyser-basic principle, protocol of their use and their application in bio-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, electron microscopy.

**Paper : BML 402: Clinical Research and Bio-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- US-FDA, EU, DCGI, ICMR, ICH-GCP, SCHEDULE-Y, IPR, HIPPA, Patent IND,NDA- Submission forms, submission process. Inspection and Audits- Regulatory Overview. Ethics Committee, IRB, DSMB. Pharmacovigilance - AE, SAE, ADR. **Introduction of system biology and bioinformatics technology and expression.**

**Paper: BML 403: Internship (Practical)**

**Full Marks – 200**

**Credit: 16**

**Course outcome:**

- To facilitate the students from practical experience about handling of patients and samples from collection to report preparation.