VIDYASAGAR UNIVERSITY,

M.Sc. Biomedical Laboratory Science and Management
Revised Syllabus (New CGPA Semester System)

w.e.f. June 2016

Vidyasagar University
M. Sc.
Biomedical Laboratory Science and Management
Revised syllabus (New CGPA semester pattern) (w.e.f. June, 2016)

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 & aboard, 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

COURSE STRUCTURE
(ME= Major Exam, IA= Internal Assessment)

Semester I

Theory Papers

Paper No.	Paper Code	Title of Paper	Marks			Credits (10 LECTURES or Hrs. / CREDIT)
			ME	IA	Total	
I	BMLS&M 101	Laboratory Bio-safety	40	10	50	04
II	BMLS&M 102	Total Quality Management	40	10	50	04
III	BMLS&M 103	Laboratory Ethics	40	10	50	04
IV	BMLS&M 104	Pathophysiology of Endocrine System	40	10	50	04

Practical Papers

Paper No.	Paper Code	Title of Paper	Marks			Credits (15 LECTURES or Hrs. / CREDIT)
			ME	IA	Total	
I	BMLS&M Pr 105	Survey on Laboratory Bio-safety	50	-	50	04
II	BMLS&M Pr 106	Survey on Total Quality Management	50	-	50	04
III	BMLS&M Pr 107	Survey on Laboratory Ethics	50	-	50	04
IV	BMLS&M Pr 108	Pathophysiology of Endocrine System and Hormone Assay Techniques.	50	-	50	04
Total Marks and Credits					**400**	**32**

COURSE STRUCTURE

Semester-II

Theory Papers						
Paper No.	**Paper Code**	**Title of Paper**	**Marks**			**Credits** (10 LECTURES / CREDIT)
			ME	**IA**	**Total**	
I	BMLS&M 201	Reproductive Events and Assisted Reproductive Technology	40	10	50	04
II	BMLS&M 202	Haematology and Transfusion Science	40	10	50	04
III	BMLS&M 203	Computer Applications and Bio-Statistics	40	10	50	04
IV	BMLS&M 204	Optional Paper	40	10	50	04
	OPTIONAL PAPER For other Dept. students	Life Style Disorder-1 and Community Health	40	10	50	04
Paper No.	**Paper Code**	**Title of Paper**	**Marks**			**Credits** (15 LECTURES / CREDIT)
			ME	**IA**	**Total**	
I	BMLS&M Pr 105	Reproductive Events and Assisted Reproductive Technology	50	-	50	04
II	BMLS&M Pr 106	Haematology	50	-	50	04
III	BMLS&M Pr 107	Immunohaematology and Transfusion Science	50	-	50	04
IV	BMLS&M Pr 108	Computer Applications and Statistics	50	-	50	04
Total Marks and Credits					**400**	**32**

COURSE STRUCTURE

Semester-III

Theory Papers						
Paper No.	**Paper Code**	**Title of Paper**	**Marks**			**Credits** (10 LECTURES / CREDIT)
			ME	**IA**	**Total**	
I	BMLS&M 301	Clinical Immunology and Serology	40	10	50	04
II	BMLS&M 302	Cytogenetics and Histotechnology	40	10	50	04
III	BMLS&M 303	Clinical Biochemistry	40	10	50	04
IV	BMLS&M 304	OPTIONAL PAPER	40	10	50	04
	OPTIONAL PAPER for other Dept. students	Life Style Disorder-2 and Environment and Health	40	10	50	04
Paper No.	**Paper Code**	**Title of Paper**	**Marks**			**Credits** (15 LECTURES / CREDIT)
			ME	**IA**	**Total**	
I	BMLS&M Pr 305	Immunology and Serology	50	-	50	04
II	BMLS&M Pr 306	Cytogenetics and Histotechnology	50	-	50	04
III	BMLS&M Pr 307	Clinical Biochemistry	50	-	50	04
IV	BMLS&M Pr 308	Practical on Basic Molecular Biochemistry	50	-	50	04
Total Marks and Credits					**400**	**32**

COURSE STRUCTURE

Semester-IV

Theory Papers						
Paper No.	**Paper Code**	**Title of Paper**	**Marks**			**Credits** (10 LECTURES/ CREDIT)
			ME	**IA**	**Total**	
I	BMLS&M 401	Pathology	40	10	50	04
II	BMLS&M 402	Parasitology, Mycology, Microbiology and Bacteriology	40	10	50	04
III	BMLS&M 403	Advance Techniques in Laboratory Science	40	10	50	04
IV	BMLS&M 404	Clinical Research and Bio-informatics	40	10	50	04
Paper No.	**Paper Code**	**Title of Paper**	**Marks**			**Credits** (20 LECTURES / CREDIT)
			ME	**IA**	**Total**	
I	BMLS&M Pr 405	Pathology	50	-	50	04
II	BMLS&M Pr 406	Parasitology, Mycology, Microbiology and Bacteriology	50	-	50	04
III	BMLS&M Pr 407	Submission of Thesis	50	-	50	04
IV	BMLS&M Pr 408	Training programme in hospital/NGO & Educational visit to Higher Research Institute or Diagnostic Industry	50	-	50	04
Total Marks and Credits					**400**	**32**

1st Semester (Theoretical)

Laboratory Bio-safety

Paper – BMLS&M 101

Full Marks – 50
(60 rs Lectures)

Various types of laboratories. Code of good and safe laboratory practice for support staff and responsibilities of the workers regarding Bio-safety. ISO rules for laboratory medicine. Set up of a laboratory on the basis of safety priority and Laboratory Biosafety Guidelines. Laboratory Biosafety Level Criteria (BSL-1-4). Handling, transfer and shipment of specimen. Decontamination and disposal. Treatment and disposal technologies for health- care waste. Wastes management, life cycle of bio-medical wastes. Reduce recycle and reuse of wastes, technology used for bio-medical wastes treatment and disposal. Chemical, electrical, fire and radiation safety. Safety organization.General Safety checklist. Hazardous properties of instruments and Laboratory chemicals. Laboratory first-aid measures and kit. Safety equipments. Safety signs and signage system in laboratory and hospital.

Total Quality Managemet

Paper – BMLS&M 102

Full Marks 50
60 rs Lectures)

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. Systemic and random errors. Quality control charts: Levy-Jenning chart, Cusum chart and Gaussian curve. Reference value. Standard Bio-Medical Laboratory set up as per working criteria. Management to the client, patient, physician, administrative authority. Marketing management and economics related to Bio-medical laboratory science. Cost of conformance & non-conformance. Principles of management of employees relations. Good laboratory management practices.

Laboratory Ethics

Paper – BMLS&M 103

Full Marks – 50
(40 hrs Lectures)

1. 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.

Pathophysiology of Endocrine System
Paper – BMLS&M 104

Full Marks-50
(40 hrs Lectures)

1. Techniques followed in 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. Interpretation. Endocrine glands. Information on pituitary- gonadal axis, feedback system, function, pathophysiology (male and female). Information on pituitary-thyroid axis, feedback system, function, goiter and goitrogens – its pathophysiology. Inforamtion on pituitary-adrenocortical axis feedback system: Pathophysiology. Information on pancreatic-hormones, regulation, function, disorders. Dynamic Test on pituitary gonadal activities, thyroid activities, adrenal activities, pancreatic activities. Hormonal disorders in diabetes mellitus- its types-symptoms, cause, management. Diabetes insepidus- cause, symptoms and management. Cause, symptoms and management of Hypertension, Obesity, Hypogonadism, Sterility, Goiter, Growth hormone diseases, Adrenocortical syndromes

(Practical)
1st Semester
Survey on Laboratory Bio-safety
Paper – BMLS&M Pr. 105

Full Marks –50
(60 hrs)

Survey on Total Quality Management
Paper – BMLS&M Pr 106

Full Marks-50
(60 hrs)

Survey on Laboratory Ethics
Paper – BMLS&M Pr 107

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Full Marks-50
(60 hrs)

Pathophysiology of Endocrine System and Hormone Assay Techniques
Paper – BMLS&M Pr 108

Full Marks – 50
(60 hrs)

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. Programming in Gamma counter for hormone. Standard curve in Gamma counter. Hormone assay in Gamma counter. Interpretation of results of LH, FSH, testosterone , estradiol and PRL from same serum sample(As per sex). Interpretation of results of TSH and T3 / T4from 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. Assessment of obesity by the estimation of lipid profile. Assesment of hypertension by the estimation of cholesterol. Assessment of atherosclerosis. Evaluation of autoimmune disorder in relation to pathophysiology of endocrine gland. Immuno endocrine evaluation with special reference to cytokines / growth factor.

Theoretical

2nd Semester

Reproductive Events and Assisted Reproductive Technology
Paper -BMLS&M 201

Full Marks - 50
(40 hrs)

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
Ogenesis ,Ovulation and its hormonal control. Menstrual cycle and its biochemical model explanation. 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. Placenta and pregnancy maintenace, Endometriosis. Sperm viability. Testing for antibody coating of spermatozoa, Immunobead test, Mixed antiglobulin reaction test, Sperm cervical mucus Interaction capillary tube test, Measurement of reactive oxygen species generated by sperm suspensions, Assessment of neutral alpha glucosidase, Zinc. Leukocyte count in semen. Acrosome testing. Detection of rape by police department-acid phosphatase study. Assisted reproductive technology (ART). Causes of male and female infertility. Process of IUI, IVF, GIFT, ICSI - Limitation – advantages and disadvantages. Process of super grade quality of sperm collection in ART.

Haematology and Transfusion Science
Paper -BMLS&M 202

Full Marks -50
(40 hrs)

Introduction to haematology: haematopoietic system. Components of blood– Cellular part & acellular part, erythropoiesis, leucopoiesis & thrombocytosis. Basic mechanism of blood coagulation. Hemoglobin – chemistry, synthesis and factor regulation its synthesis, Types of Hemoglobin, and hemoglobin and its measurement.
Blood collection. Anticoagulant, used for collection with its – merits and demerits. Automation in haematology: Electrical Impedance, light scattering, FACS etc., Haematology histograms. Routine hematological tests and Bleeding disorders & Important routine coagulation test. Special hematological test – glycosylated hemoglobin, G6PD deficiency anemia, L.E cell preparation, estimation of fetal hemoglobin , hemoglobin electrophoresis, fragility test of blood cells, preparation of bone marrow smear, peroxides test, alkaline phosphates test, red cell pyruvate kinase test (for reticulocytosis); tests for Hemophilia, iron and total iron binding capacity (TIBC), plasma haemoglobin, intravascular haemolysis, hepatoglobin and hemolytic anaemia. Naked Eye Single Tube Red Cell Osmotic Fragility test (NESTROF test), acidified serum test and sucrose lysis test (for paroxysmal nocturnal haemoglobinuria). Plasma recalcification time, protamine sulphate test, determination of fibrinogen and its significance. Laboratory reports preparation & interpretation of laboratory findings in hematology. Haemoglobinopathies and blood cancer. Haemolytic diseases of the newborn, Idea about thalasemia 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, Conditions for blood transfusion, Blood transfusion in total or in fractionated part. Disorder due to mismatched blood transfusion and Erythroblastosis foetails. Transmission of diseases in relation to blood transfusion Importance of blood test before marriage to check the transmission of haemolytic diseases in next generation. Collection, processing of blood for transfusion and container for blood collection. Anticoagulant solution used in blood transfusion bag, Screening of donor for blood collection, transportation of blood after collection and storage of blood. Laboratory procedure in blood transfusion, Anti human globulin test, Cross matching. Antibody screening test & cold agglutination test.

Computer Applications and Bio- Statistics
Paper -BMLS&M 203

Full Marks -50
(40 hrs)

Dilutions- mathematical basis of samples. Strength of solution-Conversion-Mathematical approach. Logarithms Colorimetry- Mathematical approach. Graphs- Mathematical approach. Medical statistics: mean, median, mode, SD, SEM, probability, t-test, null hypothesis, co-relation, chi-square, ANOVA, Duncun's test. 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, data storage and database formation, data bank. Use of software for cell count, cell diameter measurement. photomicrograph system. UV-spectrophotometer. Statistical analysis of data in computer using software. Use of internet in Bio-medical Laboratory Science. Common trouble shooting during computer operation.

Optional

Paper -BMLS&M 204

Full Marks-50

(Practical)
2nd Semester
Reproductive Events and Assisted Reproductive Technology
Paper -BMLS&M Pr 205

Full Marks - 50
(60 hrs)

Sperm count in ejaculated semen nad 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.

Haematology
Paper -BMLS&M Pr 206

Full Marks - 50
(60 hrs)

Blood film preparation & its staining, identification of different types of leucocytes. Collection of blood samples from vein. Determination of ESR, haemoglobin concentration, PCV, T.C. & D. C., Determination of MCV, MCH, ESR and MCHC. 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. Blood analysis by automatic analyzer, only demonstration. Estimation of different types of haemoglobin & plasma haemoglobin. 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 glycocylated 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.

Immunohaematology and Transfusion Science
Paper -BMLS&M Pr 207

Full Marks - 50
(60 hrs)

Separation of plasma and serum. Blood grouping and Rh typing. Reagent preparation of blood banking and demonstration of blood bank. Detection of Thalasemia 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

Computer applications and Statistics
Paper -BMLS&M Pr 208

Full Marks – 50
(60 hrs)

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.
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, ORIGIN, SIGMA PLOTER 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.

3rd Semester (Theoretical)
Clinical Immunology and Serology
Paper -BMLS&M 301

Full Marks - 50
(40 hrs)

Principle of immunological reaction. Immunoelectrophoresis, counter immunoelectrophoresis, Rocket immunoelecterophoresis and nephalometry etc. Immunoturbidimetry. Principles of sero-diagnostic test: precipitation, flocculation, agglutination, neutralization, coagulation, coagglutination, microtitration, and complement fixation etc. Modern immunologic techniques, antigen antibody reaction, complements, Hypersensitive reactions, and immunosupression. Vaccination-schedule, Transplantational immunology. Immunology of tumor formation. Cytokines , Lymphokines, Interleukine, Growth factor. Hybridoma technology. Laboratory procedures in serology. Collection, preparation of specimen. Application of different types of ELISA. Different Serological screening and confirmative test for syphilis (STS). WIDAI test for salmonell typhi and CRP test, RA test. Serological tests for Lupus erythemetosus, helicobacter pylori, tuberculosis and dengue. Serodiagnosis of streptococcal Antistreptolysis O (ASO) test, streptozyme test. Different Serodiagnostic test for AIDS (HIV1 & HIV-2). Serodiagnostic test for Hepatitis. ToRCH Panel, Rubella, Toxoplasmosis. Intradermal hyper sensitively test, Montoux test.

Cytogenetics and Histotechnology
Paper -BMLS&M 302

Full Marks - 50
(40 hrs)

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. Chromosome isolation and grouping.Chromosome staining, karyotyping, gene expression and regulation.Gene mutation. Cytogenetical basis of inborn error of metabolism.Cytotechnology – Process of collection, fixative, Errors of cytology, PAP stain. Museum Technology for pathology. Health. Hazards in cytology Lab. Immunofluorescence Cytotechnology. Flow cytometry. Immunopathology of lymphomas. Cell fraction isolation, DNA, RNA quantification. Immunocytochemistry in pathology and Immunocytopathology of routine histopathology Molecular pathology and In-situ hybridization. Laboratory equipments for histology. Fixatives, types, composition, merits & demerits, limitation in use of fixative in specific case. Dehydration – mechanism, importance & care/ ethyl, Isopropyl alcohol.Clearing agents – types, merits & demerits.Infiltration, impregnation – importance. Embedding – importance and care. Section cutting, honing technique, stropping and its technique. Technique of section cutting, problems in section cutting, preparation of histological slide and mounting. Canadabalsam / Natural DPX, semi synthetic frozen section. Synthetic glycerin. Stains & staining technique in histology: Preparation of haematox ylene & eosin, special stain preparation, Weigert's iron haematoxylene, trichrome stain, phosphotungstic acid haematoxylene technique (PTAH). Reticule stain, Verhoetis stain, Congo red stain, Sudden – IV stain, PAP stain. Techniques followed in routine HE staining and some special staining like PAS, trichome staining. Staining of bone and calcified tissue. Nissl body's Toudine blue. Frozen section techniques, freezing of tissue and freezing microtomy. Staining of frozen section by PAS, Sudan – IV, Sudan block B stain, Oil red O stain. Microwave technology to histology. Microorganism staining in tissue section – Zieh Neelsen (ZN) staining M. Bacillus, Fluorescent method for M. Bacillus Crystal violet acetate method for Helicobacter Warthin-Starry method for spirochetes, Hexamine silver for Fungi, Giemsa stain for parasite. Ninhydrine-schif method for aminogroup, Millon reaction for tyrosine, Performic-Alcian Blue for disulfide linkage, Fecelgen nuclear reaction for DNA and Methyl green-Pyronin method for RNA. Automation in histotechnology. Automatic tissue processing, techniques, care, limitation. Automatic tissue staining, techniques, care and limitation. Immunohistotechnology and Immunofluorescence Histotechnology.

Clinical Biochemistry
Paper -BMLS&M 303

Full Marks - 50
(40 hrs)

Basic concept of physiology and biochemistry and molecular biochemistry of the body. 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. Titrimetry. Photometry-flame photometry, atomic absorbption photometry. Clorimetry-visible spectrophotometer, UV spectrophotometer. Electrochemistry-clorimetry, potentiometry. Enzymes for cardiac diseases. Routine biochemical test. Determination blood glucose (Glucose-oxidase method). Determination of total protein in serum. Determination of Serum albumin, blood urea (Oxime method), S. creatinine, Alb. Globulin ratio, alkaline phosphatase (alkaline picrate method), uric acid (phosphotungstate method) (Kit method in available cases), blood bilirubin (Malloy & Evelyn method), serum triglyceride (Clorimetric method), blood, HDL cholesterol (Modified Lepter method, kit method), LDL, VLDL, serum calcium, potassium, chloride, sodium, phospholipid. Determination of serum and plasma bicarbonate. Enzyme assay in clinical biochemistry-SGOT/SGPT/ACP/ALP/ γ-GT/ LDH/Amylase/CPK. Different Renal, Liver, Gastric, Pancreatic, Cardiac function test. General screening for alcohol, methanol and acetone – toxicity assessment. Determination of carbon monoxide– toxicity assessment. Screening of drug like phenothiozyne derivative, acetaminophens carbamazepine, ethosuximide, Phenobarbital, phenytoin, pyrimidine. Chloral hydrate and halogeanted hydrocarbons, impramine, salicylates, digoxin, caffeine, deryphylline, cyclosporine, Screening of heavy metals- Hg, As, Fl, Pb and Li.

OPTIONAL PAPER
Paper -BMLS&M 304

Full Marks-50
(40 hrs)

(Practical)
3rd SemesterPaper
Immunology and Serology
Paper -BMLS&M Pr 305

Full Marks - 50
(60 hrs)

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. Montoux test.

Cytogenetics and Histotechnology
Paper -BMLS&M Pr 306

Full Marks 50
(60 hrs)

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.

Clinical Biochemistry
Paper -BMLS&M Pr 307

Full Marks - 50
(60 hrs)

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 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.

Practical on Basic Molecular Biochemistry
Paper -BMLS&M Pr 308

Full Marks - 50
(60 hrs)

Cell separation, fractionation. Separation of protein and protein electrophoresis (native gel, SDA Page), molecular weight determination of protein Western blot,. Detection of immunoglobulin, SRID, Ouchterlony double diffusion, Immuno electrophoresis, Counter immuno electrophoresis, Rocket immune Electrophoresis, Isolation, quantification / Purification of DNA, RNA and agarose gel Electrophoresis. PCR. Documentation of proteomics and genomics study by imaging system.

4th Semester (Theoretical)
Paper -BMLS&M 401
Pathology **Full Marks - 50**

(40 hrs)

Physiology of urine formation, Normal composition of urine, Collection of urine Specimen. Types of urine specimen, preservation of urine.Biochemical analysis of urine. Routine examination of urine- physical, microscopic examination of urine specimen. Determination of Urinary haemosiderin. Routine examination of stool. Chemical test of urine (for Glucose, protein, ketone, bilirunin, urobilinogen, blood Laboratory examination of miscellaneous body fluids (pleural fluid, pleural effusion, peritoneal fluid, peritoneal effusion). Collection and processing of CSF and its laboratory investigation. Types of meningitis and in CSF pictures. Laboratory investigation serous fluid, synovial fluid and gastric juice. 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.

Parasitology, Mycology, Microbiology and Bacteriology
Paper -BMLS&M 402

Full Marks - 50
(40 hrs)

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. Quality control in clinical mycology. 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. Laboratory diagnosis of dermatomycosis. Laboratory diagnosis of subcutaneous mycosis systemic mycosis. Basic rules for working in the diagnostic microbiology laboratory. Specimen collection and handling. Laboratory records & reporting of results. Safety regulation for the microbiology laboratory. Disposal of specimens after laboratory use. Morphological study, Staining procedure-gram staining, Acid fast staining, Albert staining and spore staining. Biochemical test for bacterial differentiation (*E. coli, S. haemoleticcus, Klebsyella, Staphylococcus, Streptococcus, Clostridium, Nisseria*

etc.). Culture media and basic techniques in the preparation of culture media, Growth curve of bacteria, primary culture and secondary culture. Aseptic transfer of microbes. Quality control in microbiology. Systemic grouping of pathogenic bacteria. Identifying characteristics of common pathogenic bacteria. Preparation of culture media for pathogenic bacteria. Mycobacterial susceptibility test. Laboratory diagnosis of Haemophilus influenza; Pulmonary tuberculosis; Dysentry and Diarrhoea; Cholera; Renal infection and Gonorrhoea Antibiotic sensitivity tests.

Advance Techniques in Laboratory Science
Paper -BMLS&M 403

Full Marks - 50
(40 hrs)

NMR(Nuclear magnetic resonance). Polygraph. Laparoscopy. Physiological basis of ECG & EEG. Recording method followed in ECG along with different leads. Laboratory investigation of ECG records and interpretation. Signification of ECG for prediction of cardiac condition. Basic principle of Centrifuge machine (ordinary, ultra and cold). Basic principle of Semi auto/auto analyzer, spectrofluorometer, flame photometer, luminometer, Sonicator, Lyophilizer. ELISA reader, RIA counter, Flow cytometry and CASA device, 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- Impact on world health. 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 , HIV and hepatic infections. Genomics, transcriptomics, proteomics and metabolomics - Principle and application for diagnosis ofvarious 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.

Clinical Research and Bio-informatics
Paper -BMLS&M 404

Full Marks - 50
(40 hrs)

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

4th Semester (Practical)
Pathology
Paper -BMLS&M Pr 405

Full Marks – 50
(60 hrs)

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 synuvial 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.

Parasitology, Mycology, Microbiology and Bacteriology
Paper -BMLS&M Pr 406

Full Marks – 50

(60 hrs)

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.

Paper -BMLS&M Pr 407
Submission of Thesis

Full Marks – 50
(60 hrs)

Paper -BMLS&M Pr 408

Full Marks – 50
(60 hrs)

1. Training in Hospital / NGO / Private Sector within Locality.
2. Laboratory demonstration and Educational outing for exposure of the students to higher health service/research institute.

2nd Semester
Paper-204
OPTIONAL PAPER for interdepartmental choice
Life Style Disorder-1 and Community Health

Full Marks – 50
(40 hrs)

Concept of health and disease. Epidemiology (morbidity and mortality). Non-Communicable Diseases(NCD) with Lifestyle and Lifestyle Diseases; Cardiovascular Disease,s Cancer, Allergies, Asthma, Diabetes, and Arthritis. Hereditary Diseases, Immune Disorders and Autoimmune Disorders, Disabilities. Communicable Diseases and life style, Promotion Strategies (in general), Health Promotion in schools, Health Promotion in community School Health Programmes. Role of Diet and Nutrition. Good and bad practices of dietary habits, Designing, implementing, monitoring and evaluation of health promotion programme.

2nd Semester
Paper-304
OPTIONAL PAPER for interdepartmental choice
Life Style Disorder-2 and Environment and Health

Full Marks – 50
(40 hrs)

Life style with anxiety, Tobacco, alcohol and Drug addiction, Mental health and Stress management, Physical activity and yoga, Environmental Awareness and Health. Toxicology and Risk assessment, Infectious Diseases and role of environment, Non-Infectious Disease, Health hazards of Ambient Air Pollution, Indoor Air Pollution, Automobile exhausts, occupational health hazards, Persistent Organic Pollutants, Water Supply, Wastewater Treatment, Foodborne Illness, Pesticides, Biomonitoring, health hazards of Arsenic, fluoride, Lead, Mercury and Risk Management, Radiation, Industrial Ecology, Environmental safety issues at indoor and outdoor, Environmental Justice.