



**MAHARSHI DAYANAND SARASWATI UNIVERSITY  
AJMER**

**NOTICE**

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संस्कृत

**SYLLABUS**

**SCHEME OF EXAMINATION AND COURSES OF STUDY**

**FACULTY OF SCIENCE**

**P.G Diploma in Laboratory Technology and Instrumentation Examination**

(w.e.f. Session 2018-19)

**संस्करण  
2019**



**मूल्य :  
20/-**

## POST GRADUATE DIPLOMA IN LABORATORY TECHNOLOGY AND INSTRUMENTATION

### Regulation

The examination shall be conducted at the end of the academic session as per scheme of Examination. Duration, division and other conditions are specified below:

### Eligibility for Admission

A graduate of Science (Biogroup) at least 50% marks in aggregate.

Total number of seats available 20

In general Category 14

Reserved for SC/ST/PH 3 (SC)+2(ST)+1 (PH)

(May be modified as per the current reservation regulation of the university from time to time.)

With minimum 50% of marks

Further the university may take decision at any time for admission test prescribed for the purpose.

### Minimum Pass marks & Duration of course

The minimum pass marks required in aggregate are 36% Subject to a minimum of 25% marks for each paper subject to this provision that minimum requirement for a first division= 60% second division 50%. All the rest will be declared to have passed in the examination.

The duration of course is spread over on one academic year.

There will be no supplementary Examination. However, if a student fails, maximum one chance will be given in the next subsequent academic session to pass the examination, but if a student passed in Project/Practical his marks will be carried forward for the next examination and thus he is exempted to reappear in the Project Report and Practicals in the next subsequent session. There will be a practical of 150 marks based on paper I, II, III of 5 hours duration, marks for each theory paper will be 100. There will be 50 marks for Project Report. The maximum time allowed for each paper is three hours in theory. Project report will be submitted at the time of practical examination for evaluation based on field observation including educational tour, laboratory exercise etc. related to problems of laboratory technology, biomedical instrumentation or medical laboratory Technology.

### Instruction

Medium of instruction in English or Hindi.

### Revaluation

Revaluation of papers is allowed only in any one paper, Revaluation in Project Report/ Practicals is not allowed.

### Requirement for Attendance

Minimum attendance is required as per University rules.



**Examination Fee**

Examination fee is prescribed by the university and no carrying forward of fee is allowed on any ground.

Utilization of Faculty Development Fund.

- Scholarship for 2 toppers based in the merit of the qualifying examination/ Entrance test, whichever is applicable.
- Educational Tour.
- Hospital/Medical college based training expenses.
- Literature survey based of Internet.

Scheme of Examination	Time	Max. Marks
Paper - I General Laboratory Technology	3 hrs.	100
Paper - II Instrumentation and Maintenance	3 hrs.	100
Paper - III Special Paper (any one of the following)		
(a) Medical Laboratory Technology	3 hrs.	100
(b) Molecular and Developmental Biology Laboratory Technology	3 hrs.	100
Practical based on Paper I, II, III and project report.	4 hrs.	50

- WORKLOAD**
- Theory: Six hours per paper per week.
  - Practical: Four hours per paper per week.
  - Project: One hour per week for a group of four students Each.

**Paper I General Laboratory- Technology****Unit I**

- GLT 101 Introduction & importance of microtechniques, collection, fixation and preservations of biological material - principle of fixation, fixatives, and methods of fixation, post-fixation and preservation.
- GLT 102 Preparation of permanent slides: preparation for mounting, mounting media and procedure for whole mounts.
- GLT 103 Microtomy Principles and techniques. Preparation of tissues for thin and ultra thin sectioning, fixation, dehydration, clearing, infiltration and embedding.
- GLT 104 Staining techniques, principles and various types of strains including natural and synthetic dyes.
- GLT 105 In- toto staining of biological specimen. Alizarin and Victoria blue & double staining Techniques.

**Unit- II**

- GLT 106 Epoxy resin embedding technique. Various types of epoxy resin, catalyst, accelerators of.
- GLT 107 Dark room technique. Still and time lapse photography developing and processing of photographic film and printing Autoradiography-principle and technique. Analysis of autoradiography.

GLT 108 Laboratory Management : Laboratory classification designing and Layout of hightech laboratories and medical laboratory system designing and data management, personel management. Concept of technician and technologist.

GLT 109 Living Resource material for Biomedical Sciences Design and layout of animal breeding and maintenance centre, care and breeding of common laboratory animals. Frog, Fish, Drosophila, Mouse animals laws for biodiversity research laboratories. Preparation of pure culture of Paramecium, Euglena, Amoeba, Hydra, water sponges, Planaria.

**Unit- III**

GLT 110 Principles of photometry (fundamentals only) colorimetry/ spectrophotometry: Spectro photometer techniques- General principles: types, applications of UV spectrophotometry and semiautoanalyzer. Application and principles of dry biochemistry IR spectrophotometry, circular dichroism (CD) spectrophotometry. Spectrophotometry / Semiautoanalyzer procedure related to estimation of proteins, carbohydrates, lipids and nucleic acids of a given samples.

GLT 111 Analytical separation methods (Fundamental only). Chromatography : General principle, classification, application and types of column. thin Layer chromatography, partition chromatography, gas liquid, affinity, HPLC (High Performance/Pressure Liquid chromatography).

**UNIT- IV**

GLT 112 Electrophoresis-General principle, application and type: Low voltage thin sheet electrophoresis, high voltage electrophoresis, gel electrophoresis- SDS PAGE, Iso-electro-focussing (IEF): Isotachopheresis Molecular weight estimation elementary Knowledge about DNA hybridization, recombinant DNA technology, polymerase chain reaction, DNA finger printing technique.

GLT 113 Environmental analytical methods: Estimation of pH, CO<sub>2</sub>, N<sub>2</sub>, Ca, K, P, O<sub>2</sub>, Fluoride hardness, alkalinity, toxicants in water samples, Waste water treatment technology-solid waste recycling, fundamentals of environmental microbiology and toxicology.

**Unit- V**

GLT 114 Culture and staining of non-pathogenic and pathogenic Bacteria, Elementary knowledge about Bacteria structure, classification, culture media, techniques of pure culture, staining methods, permanent preparation and application in bio technology.

GLT 115 Cell, tissue, organ and embryo culture: Design and layout of tissue culture laboratory, aseptic techniques: laboratory safty and Bio-hazards, gas phase, temperature, media and supplements, culture techniques, maintenance of cell line, tissue culture, organ and embryo



culture-hanging drop methods, New's ring technique, aurbach's culture method for chick embryos, culture of mammalian embryo. Preparation of polytene chromosomes of *Drosophila larva* using Salivary gland culture.

**Practical based on Paper I**

(Practical exercises based on the above mentioned topics will be carried out during the practical classes.)

**PAPER II INSTRUMENTATION MAINTENANCE**

**Unit I**

IM-201 Introduction of Electricity: Modes of conduction, properties of electricity-electromagnetic effect, electrostatic effect. Piezo electric effects, simple electrical circuits, alternation current circuits, advantages of A.C. supply. Reactive load and reactive power and D.C. supply.

IM-202 Measurement of Electrical parameters: Display devices, current measurement, measurement of resistance, Power: power supply, distribution, grounding, Multimeters: multimeters circuit, protection of multimeter, care and maintenance of multimeters, Relative advantages of different types of multimeters. Identification and measurement of passive component: resistance, capacitors, inductances, transformers, diodes, triodes and pentodes, and I.C. integrated circuit technology.

**Unit II**

IM-203 Safety of laboratory equipments: safety of personnel operating and using instruments, power supply stabilization, environmental conditions, fuses, soldering: solder ally, preparations for soldering, soldering iron, hints for careful soldering practice.

IM-204 Analogue and digital display devices- Analogous to digital and digital to analogous conversion. Display meters, methods of testing, voltage stabilizers, power supply.

IM-205 Voltage regulators: AC voltage stabilizer, servo stabilizer, resonance type stabilizer electronic voltage stabilizer, DC power unit. Principles and operation.

**Unit- III**

IM-206 Electric Motors: Basic principles of electric Induction motors, basic principles of magnetism, basic principles of electromagnetism, electromagnets, advantages of electromagnets, Basic principles of induction motor, squirrel cage motor, split phase motor, shaded pole motor, SCR regulator. Common defects of the A.C. and D.C. motors and their remedy.

IM-207 Thermal Equipments: Principles and application, Incubators, oven, water bath autoclave, BOD incubators, thermal conductivity of

M-208 Insulators, control of heating circuits, low temperature thermostates. Balance Principle and operation of single and two pan balances, substitution balance, top loading and analytical balances, electrical weighing system, digital balances. Digital Electronic equipment : Principles and maintenance.

**Unit-IV**

M-209 Photo electric equipment: Terminology and basic components of photometer, spectrophotometer, spectrometers, radiant energy sources (types of lamps). Dispersing device, filter, diffracting grating, photoreceptors, barrier layer cell, photo sensitive tubes, photo multiplier tubes (PMT). Flame Photometer, Fluorescence measurements, ph meter and maintenance of electrodes, precaution.

IM-210 Elementary concept of the principle and functioning of Microscopes, Monocular and binocular light Microscope, phase contrast Microscope, interference Microscope, polarizing Microscope, Dark field Microscope, Fluorescent Microscope electronmicroscope (TEM & SEM).

IM-211 Microtome and Microtome knives: Maintenance of Microtomes, types of Microtome (rotary, sledge, rocking, freezing, cryostat, ultramicrotome). Maintenance of Moving part, knife, handling and sharpening of knives.

**Unit- V**

IM-212 Principle and Maintenance of Audio-visual equipments: Types of projector, Maintenance, installation and care of projectors, Modern audiovisual teaching aids.

IM-213 Sterilization Equipments: Principle and Maintenance of laminar flow bench (Vertical and horizontal laminar flow), culture hood, autoclave, hot air oven

IM-214 Computer application in Science laboratories, fundamentals of computer, History and generation of computers: computers peripherals, elementary idea about common software packages, operating system software, Application system softwares word processing, database, Management, software related to biomedical sciences, Windows 98 or any latest version. Internet and its Application.

**Practical Based on Paper- II**

(Practical exercises based on the above mentioned topic will be carried out during the practical classes)

**Paper III Special Paper Medical Laboratory Technology**

**Unit I**

( MLT-30) Heatmatology: E.S.R. Principles and Estimation, Interpretation and



various methods, haemoglobin-formation fate and functions. Principles of various methods in Haemoglobinometry. Theory of blood coagulation, factors involved, extrinsic and Intrinsic pathway, cascade theory, Iron Metabolism, total RBC and WBC count, Bleeding time, Clotting time, Prothrombin time, D.L.C. normal abnormal films Platelets-count & functions Packed cell volume.

**MLT-302** Blood Bank Techniques and serology, ABO system. Nature of antibodies, Anti A.B.O. Rh grouping system tests, Antibody titrations, reasons and methodology, Immunology: Basic definitions, basic aspects of the immune response; humoral division, cellular division, Types of antigen. Types immunisation Heterophile antigen basic structure, types biological properties of immunoglobulins, complement, autoimmunity & immune disease, with special reference to AIDS.

#### Unit II

**MLT-303** Clinical Biochemistry: Principles, Metabolism and clinical interpretation Estimation of bilirubin, creatinine, enzymes alkaline and acid phosphatase amylase LFT, OT, PT, Lipid profile Glucose, uric acid, serum proteins, Na, K, HCO<sub>3</sub>, Cholesterol, Total Ca, P, Lipids, pH, indicators and Buffers, Introduction to automation in clinical chemistry, Basic concepts, types of analysers, RIA/ELISA Techniques.

#### Unit-III

**MLT-304** Clinical pathology: (i) Urine analysis: Chemical examination of urine by strip, specific gravity, pH, Albumin, sugar, principle of Albumin tests with interpretation Principle and interpretation of glucose, Bile salt, Bile pigments, Porphyrines Porphobilinogen, urobilinogen amino acid urea phenyl- ketone based Urea Homogentisic acid and calcium, urine microscopy etc. (2) Stool analysis- Gross and Microscopic (3) Semen analysis.

**MLT-305** Bacteriology: Structure and Biology of Bacteria, Bacterial respiration, reduction, nutrition and growth Basic constituents of culture media, liquid, semisolid and solid different methods of inoculation and streaking, aerobic and anaerobic methods of culture. Sample collection and staining of human pathogenic bacteria; mycobacteria, viruses, fungus, culture of urine, pus, C.S.F. sputum, semen blood, stool, throat swab, Skin scraping and drug sensitivity tests. Preservation & Stock of cultures. Principle of lyophilization and making of vaccines autovaccines.

#### Unit IV

**MLT-306** Parasitology: Protozoa classification and general morphology. Trichomonas, Giardia intestinalis, Plasmodium, Trypanosoma; Entamoeba histolytica, Leishmania.

**MLT-307** Helminthology Study of parasitic nematodes, round worm, hook

worm, Pin worm, whip worm, tissue nematodes such as Wuchereria and trematodes Taenia Solium Saginata, Echinococcus.

#### Unit V

**MLT-308** Histopathology: Introduction to Histology Study of normal and pathogenic tissues from permanent slides autopsy & biopsy. Handling of biopsy specimens. malignancy types & detection: Exfoliative cytology FNAC and cell block.

**MLT-309** Principles of Radiology: computer Aided Tomograph (CAT) encephalography, sonography, echocardiography, MRI: X-rays technology.

#### Practicals based on Special Paper-III

(Practical exercises based on the above mentioned topics will be carried out during the practical classes.)

#### Special Paper-III Molecular and Development Biology Laboratory Technology Molecular Biology Laboratory Technology

#### Unit-I

**MDBLT-301** Radio-isotope techniques in macromolecular synthesis and distribution

**MDBLT-302** Ultra centrifugation Separation of molecules differing in mass and or density. Sedimentation rate; zonal centrifugation, equilibrium density gradient centrifugation sedimentation constants.

**MDBLT-303** Separation methods in molecular Biology: Liquid chromatography, Paper chromatography, thin layer chromatography, high performance liquid chromatography, Gas chromatography. (principles and techniques). Electrophoretic Techniques, Moving boundary electrophoresis, cellulose acetate electrophoresis, rod gel electrophoresis, slab gel electrophoresis.

#### Unit- II

**MDBLT-304** Principles and methods of Genetic engineering: DNA transformation techniques application in Agriculture, health, medicine and industry. Nucleic acid hybridization techniques, southern blot and Northern blot techniques.

**MDBLT-305** Recombinant DNA techniques- DNA damage and repair, amplification, sequence re-arrangement.

**MDBLT-306** Regulation of Gene expression: DNA methylation.

#### Unit- III

**MDBLT-307** Molecular biology of cancer, oncogenes: chemical carcinogenesis.

**MDBLT-308** Lysogeny and lytic cycle in bacteriophages: bacterial transformation host cell restriction: transduction;

complementation, molecular recombination and genomic libraries, DNA ligases, topoisomerases, gyrases, methylases, nucleases, restriction endonucleases, plasmids, cosmids, charron phases and their use in gene cloning for cDNA libraries and genomic libraries.

**Unit- IV**

**DEVELOPMENTAL BIOLOGY: Laboratory Technology**

- MDBLT-309 Induced spawning in anurans/fish: principle & methods.  
MDBLT-310 In vitro Fertilization of eggs and study of early development, using suitable experimental model.  
MDBLT-311 Cell, Tissue, Organ and embryo-culture-Techniques  
Micromanipulator techniques: Nuclear transplantation experiments. Primary culture, cell line, cell clones soma clonal variations. Gene transfers by micro injection.

**Unit- V**

- MDBLT-312 Cryopreservation techniques embryo-bio-technology. Tissue transplantation technology. Preparation of host and graft transplantation and development of graft.  
MDBLT-313 Demonstration of cell death in developing limb of chick embryo. Genetic control of development. Effect of retinoids on development of vertebrates, hormonal control of insect and frog metamorphosis, teratogenesis.  
MDBLT-314 Wound healing, dedifferentiation, redifferentiation, pattern formation in vertebrate limb regeneration. Homeotic transdifferentiation, Exo-utero development and Intra-amniotic surgical techniques in chick and mammalian embryos.

**Practical based on Special Paper- III**

(Practical exercises based on the above mentioned topics will be carried out during the practical classes).

