THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI - 600 032.

SYLLABUS AND REGULATIONS
M.Sc. (NON-MEDICAL) COURSES

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REGULATIONS AND SYLLABUS FOR M.Sc. POST-GRADUATE (NON-MEDICAL) COURSES

In exercise of the powers conferred by Section 44 of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, Act, 1987 (Tamil Nadu Act 37 of 1987), the Standing Academic Board of the Tamil Nadu Dr. M.G.R. Medical University, Chennai hereby makes the following Regulations :-

1. SHORT TITLE AND COMMENCEMENT :

These regulations shall be called "THE REGULATIONS FOR THE M.Sc. POST-GRADUATE (NON-MEDICAL) COURSES OF THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI".

They shall come into force from the academic year 2008-2009.

The Regulations and the Syllabi are as prescribed under these Regulations and are subject to modification by the Standing Academic Board from time to time.

2. MEDIUM OF INSTRUCTION:

English shall be the medium of instruction for all the subjects of study and examination of M.Sc. Non-Medical Courses.

3. BRANCH OF STUDY :

Candidates shall be examined in one of the following branches :

M.Sc.

Branch I : Anatomy
Branch II : Physiology
Branch III : Bio-chemistry

4. ELIGIBILITY :

Candidates seeking for admission to the first year of the M.Sc. Post-Graduate Degree (Non-Medical) Courses shall be required to possess the following qualifications:

M.Sc. (Anatomy): Candidates who have passed B.Sc. Zoology / Biology / Bio-Sciences / Life Sciences / BSMS / BUMS / BAMS / BHMS / BPT / BDS .

M.Sc. (Physiology): Candidates who have passed B.Sc. Zoology / Biology / Bio-Sciences / Life Sciences / Bio-Technology / Physics / Chemistry / Bio-Chemistry / Botany / Nutrition / BSMS / BUMS / BAMS / BHMS / BPT / BDS .

M.Sc. (Bio-Chemistry): Candidates who have passed B.Sc. Chemistry / Bio-Chemistry / Bio-Sciences / Zoology / Biology / Molecular Biology / Nutrition and Dietetics / BSMS / BUMS / BAMS / BHMS / BPT / BDS .

5. ELIGIBILITY CERTIFICATE :

Candidates who have passed any qualifying examination as specified in Regulation No.4 above from any other Universities other than the Tamil Nadu Dr. M.G.R. Medical University, before seeking admission to any one of the affiliated institutions shall obtain an "Eligibility Certificate" from this University by remitting the prescribed fees along with the application form which shall be downloaded from the University Website www.tnmmu.ac.in

6. COMMENCEMENT OF THE COURSE :

The academic year for M.Sc. Post-Graduate (Non-Clinical) course shall commence from 1st April of the academic year.

7. CUT-OFF DATES FOR ADMISSION :

The candidates admitted up to 31st May of the academic year shall be registered for that academic year and shall take up their Final Third year regular examination in March of the due year. There will not be any admission after 31st May of the academic year even if the seats are unfilled.

8. EXAMINATION:

The candidate shall appear for the final examination at the end of third year. There will be no examination in the first and second years of the course.

9. DURATION OF THE COURSE :

a) The duration of certified study and training for the M.Sc. Post-Graduate (Non-Medical) course shall be three completed years (including the period of examination). The candidates are full time students.

b) No exemption shall be given from this period of study and training.

10. DURATION OF COMPLETION OF THE COURSE :

The duration for completion of the course is double the duration of the course i.e. 6 years to pass the examination, from the date of joining the course, otherwise he/she has to be discharged from the course.

11. REGISTRATION OF CANDIDATES :-

A candidate admitted into M.Sc. Post-Graduate Degree (Non-Medical) Courses in any of the affiliated Institution of this University shall register his/her name in this University by submitting the prescribed application form for Registration duly filled in all respects along with the prescribed fee and a declaration in the format (as in Annexure I of the Regulation) to the Academic Officer of this University through the affiliated Institutions within 60 days from the cut-off date prescribed for admission to the course.

12. MIGRATION / TRANSFER OF CANDIDATES :

Request for Migration / Transfer of candidates during the course of study from one recognized college to another recognized college of this university or from another university shall not be granted under any circumstances.

13. RE-ADMISSION AFTER BREAK OF STUDY :

As per the procedure laid down in a common regulation for all the courses of this university. (As approved by the Standing Academic Board in the XXVI Meeting held on 16.12.2003).

14. POSTING AND TRAINING IN OUTSIDE CENTRES :

The Head of the Post-graduate Departments should make necessary arrangements for their post-graduate candidates to undergo training in various skills in other centres within and outside the State if advanced facilities are not available in their own institution or hospitals.

15. MAINTENANCE OF LOG BOOK :

(a) Every Post-graduate candidate shall maintain a record of skills he/she has acquired during the training period certified by the various Heads of Departments where he / she has undergone training including outside the institution.

(b) The candidate should also be required to participate in the appropriate teaching and training programme of the departments.

(c) In addition, the Head of the Department shall involve their postgraduate candidates in Seminars, Journal Clubs, Group Discussions and participation in clinical, clinico-pathological conferences.

(d) Every Post-graduate candidate should be encouraged to present short title papers in conferences and improve on it and submit them for publication in reputed journals. Motivation by the Heads of Departments is essential in this area to sharpen the research skills of the post-graduate candidates.

(e) The Head of the Department shall scrutinize the Log Book every three months.

(f) At the end of the course, the candidate should summarize the contents and get the Log Book certified by the Head of the Department.

(g) The Log Book should be submitted at the time of practical examination for scrutiny by the Board of Examiners.

16. ATTENDANCE REQUIREMENTS FOR ADMISSION TO EXAMINATION :

No candidate shall be permitted to appear for the examination unless he/she has put in a minimum of 90% attendance during his/her period of study and training in the

affiliated institution recognised by this University and produces the necessary certificate of study, attendance and progress from the Head of the institution.

17. CONDONATION OF LACK OF ATTENDANCE :

There shall be no condonation of lack of attendance for the course.

18. PARTICIPATION IN CME PROGRAMME:

Every candidate has to attend a minimum of 2 C.M.E. Programme/Workshops.

19. COMMENCEMENT OF EXAMINATIONS :

The Examination for M.Sc. Post-Graduate (Non-Medical) Course shall be held at the end of third academic years (six academic terms). The Academic term shall mean six months training period.

There shall be two University examinations in an academic year.

15th March/15th September

If the date of commencement of the examination falls on Saturdays, Sundays or declared Public Holidays, the examination shall begin on the next working day.

20. DISSERTATION:

(a) All candidates admitted to undergo Post-Graduate Degree (Non-Medical) courses shall be assigned a topic for dissertation / Thesis by the head of the concerned Unit and the title of the topics assigned to the candidates be intimated to the Controller of Examinations of this University by the Head of the Department through the Head of the Institution before the end of 1st year of the course.

(b) The dissertation / thesis shall be a bound volume of a minimum of 50 pages and not exceeding 75 pages of typed matter (Double line spacing and on one side only) excluding certification, acknowledgements, annexures and Bibliography.

(c) 4 copies of dissertation shall be submitted six (6) months prior to the commencement of the theory examinations on the prescribed date to the Controller of Examinations of this University.

(d) Two copies are to be submitted as an electronic version of the entire dissertation in a standard C.D. format by mentioning the details and technicalities used in the C.D. format.

(e) The concerned Professors/Readers are to supervise and to see that the dissertations are done properly by utilizing the materials of their own department/institution. The students must learn the design and interpretation of research studies, responsible use of informed consent and research methodology and interpretation of data and statistical analysis. They should seek the help of qualified staff members in the conduct of research. If necessary, they can utilise the facilities in other Institutions. They must learn to use the library and computer based search. This training will help them to develop skills in planning, designing and conduct of research studies.

20. EVALUATION OF DISSERTATION :

a) The dissertation should be approved by the Professor of that branch and the same has to be forwarded to the Controller of Examinations by the Head of the Department through the Dean / Principal of that college six months prior to practical examination.

b) No marks will be allotted for dissertation the Post-Graduate (Non-Medical) degree course and the Board of Examiners should mark the dissertation either "Approved" or "Not Approved".

c) No grading should be given as 'Good', 'Very Good' or 'Excellent' for the approved dissertation.

d) Two copies of the evaluation report of the dissertation should be submitted by the Examiners to the Controller of Examinations of this University.

e) If the dissertation is "Not Approved" or "Rejected" by the majority of the examiners, the results shall be withheld till the resubmitted dissertation is approved.

f) If the candidate fails in the written / practical examination but his dissertation is "Approved", the approval of the dissertation shall be carried over to the subsequent examinations.

21. REVALUATION OF ANSWER PAPERS :

There shall be no re-valuation of answer papers. However, re-totalling is allowed in the failed subjects.

WHO CAN START THE COURSE?

Medical colleges that conduct MBBS Degree course of study recognized by the Medical Council of India are eligible to apply for affiliation of M.Sc (Non-Medical) Courses.

STAFF PATTERN

Two Seats

One Professor / Two Assistant Professors / Two Tutors.
One Professor, One Assistant Professor (PG Qualification), One Lecturer with MBBS qualification.
One Assistant Professor (Ph.D.) / One Tutor with M.Sc Qualification.

Facilities should be continued to be provided for all the three years. Every year to be verified.

(1.) The above staff is essential for a maximum sanctioned intake upto 2 (Two) students only.
(2.) The Staff already exist under post-graduate courses can be utilized for this course without affecting the conduct of the post-Graduate courses concerned.

M.Sc. ANATOMY (3 Years Course)

M.Sc Post-graduate degree course in Anatomy (Non-Medical) in the Faculty of Medicine

INTRODUCTION:

The M.Sc Anatomy (Non-Medical) degree course is a three year programme designed to train students to acquire an overall understanding of the structure of human body and to facilitate competence in the subject of Anatomy so as to assist in teaching.

At the end of the three year programme, the student shall be able to

1. Take part in teaching schedules of Anatomy;
2. Provide essential facts of the subject with relation to the different and various parts of the human body including microstructure;
3. Undertake procedural anatomical techniques like embalming of a human cadaver, specimen preparations for study purposes and also provide for necessary maintenance;
4. Undertake procedural histological techniques like fixing of tissue, processing of a given tissue, embedding and preparation of tissue slides, and staining of paraffin sections by regular and special methods;
5. Participate in necessary instrumentation and maintenance.

ELIGIBILITY TO ENROL, DURATION OF THE COURSE, COMMENCEMENT OF COURSE AND EXAMINATION

Details as scheduled in the Regulations of The Tamilnadu Dr.MGR Medical University, M.Sc Non-Medical Three Year Degree course in Non-Clinical subjects under the Faculty of Medicine, Common to all subjects

COURSE PROGRAMME

The Course of study shall be for a period of three years. Candidates undergoing the programme shall be full time students.

The course comprises three academic years with the student undergoing necessary training in each of these years in consecutive order.

First Academic Year – The student acquires basic knowledge in all areas of Anatomy in conformity with the curriculum and syllabus of MBBS course;

Second Academic Year – The student acquires higher levels of knowledge and gets involved in all areas of day-to-day activities of the Department of Anatomy; Greater emphasis shall be placed on acquiring teaching and pedagogic skills with regard to different areas of Anatomy, and with an ultimate objective of teaching and training under-graduate medical students;

Third Academic Year – The student acquires skills of conducting basic research in the subject; also gets involved in various teaching, procedural and maintenance activities of the Department, thus completing a full-fledged training.

EXAMINATION

- The student shall be eligible to take up the Regular University Examinations on completion of three years of study, as detailed in the course programme and course content.

- The Examination will consist of THREE THEORY PAPERS, THREE PRACTICALS and VIVA VOCE.

PASSING IN THE EXAMINATION

The candidate shall secure a minimum of 50% in the theory papers, 50% in the practicals and 50% in the aggregate to become eligible for a pass.

Dissertation does not carry any marks. However, the dissertation will be evaluated by the Board of Examiners and declared to be APPROVED / NOT APPROVED.

A candidate failing in either theory or practicals will have to reappear for theory, practicals and viva voce to be able to clear the examination in subsequent attempt. However, the dissertation, if approved, need not be submitted again.

A candidate whose dissertation is not approved by the board of examiners will have to resubmit the dissertation (after necessary rectification and compliance of errors pointed out by the board of examiners), duly forwarded by the Head of the Department and Head of the Institution. The theory and practical results of such a candidate will be kept withheld. The said results shall be declared only after the approval of the dissertation.

COURSE CONTENT AND PATTERN OF THE COURSE

General principles:
1. The student is a full-time student.
2. The student is under the Head of the Department and day-to-day allocation of work will be at the discretion of the Head.
3. The student shall maintain separate GROSS ANATOMY and HISTOLOGY record books.
4. The student shall also maintain a LOG BOOK for all his/her practical, teaching and pedagogic, embalming and specimen preparation activities during the second and third academic years.
5. The record and log books shall be subjected to periodical scrutiny by the Head of the Department or any other member of faculty assigned there of.

FIRST ACADEMIC YEAR

The student will follow pattern of MBBS (I MBBS syllabus of Anatomy) for theory, practicals, orals, discussions and seminars.

I. Areas of study will include the following:

GENERAL ANATOMY (including introduction & Terminology)

Descriptive terms; planes; basic organizational details of bones, muscles, joints and nerves; general features of muscular, vascular, nervous and locomotor systems of the body.

GROSS ANATOMY

The student shall study gross anatomy by actually carrying out dissections of human cadavers (to the same extent as that of a MBBS student); by observing and studying prosected specimens; by learning from other teaching aids as may be available.

Upper Limb

All parts and regions of upper limb – general lay out of structure – pectoral region, upper arm, fore arm, wrist and hand with details of fascia, compartments, muscles, arteries veins and other vasculature, lymphatics and nerves – All Bones in detail with regard to their structure and parts and muscular attachments – All muscles with details of attachments, actions and nerve supply -- All joints and details of capsules, ligaments, movements and muscles producing movements – All nerve plexuses of upper limb and All nerves with details of root value, origin, formation, course, relations and distribution – Details of vasculature, arteries and their branches, veins and tributaries and capillary systems – relations and systemic outlay of various parts and structure -- Necessary and applicable applied anatomy.

Lower Limb

All parts and regions of lower limb – general lay out of structure – groin, thigh, leg, ankle and foot with details of fascia, compartments, muscles, arteries veins and other vasculature, lymphatics and nerves – All Bones in detail with regard to their structure and parts and muscular attachments – All muscles with details of attachments, actions and nerve supply -- All joints and details of capsules, ligaments, movements and muscles producing movements – All nerve plexuses of upper limb and All nerves with details of root value, origin, formation, course, relations and distribution – Details of vasculature, arteries and their branches, veins and tributaries and capillary systems – relations and systemic outlay of various parts and structure -- Necessary and applicable applied anatomy.

Abdomen

Abdominal quadrants -- abdominal wall and fasciae-- inguinal region and its details -- peritoneal cavity -- abdominal viscera with details of peritoneal coverings, relations, blood supply, lymphatics, innervation and functions – abdominal blood vessels and lymphatics – sympathetic and parasympathetic pathways of concerned areas – Retroperitoneal area – nerve plexuses of the region – Thoraco-abdominal diaphragm -- Lumbar vertebrae – relations and systemic outlay of various parts and structure -- necessary and applicable applied anatomy.

Pelvis & Perineum

Pelvis, its divisions and dimensions – peritoneum and its modifications -- all pelvic viscera with details of position, relations, blood supply, lymphatics, innervation and functions – termination of abdominal aorta and its subsequent branches -- pelvic diaphragm – perineal diaphragm – superficial and deep perineal pouches – ischio-rectal fossa – pudendal region and canal – sacrum, coccyx and relevant osteology -- relations and systemic outlay of various parts and structure -- Necessary and applicable applied anatomy.

Thorax

Thorax, its extent and dimensions – thoracic wall – thoracic inlet and outlet – thoracic viscera with details of relations, blood supply, innervation and functions – pleura and pericardium – mediastinum, its divisions and structures – heart and great vessels –

thoracic vertebrae, sternum and ribs -- relations and systemic outlay of various parts and structure -- necessary and applicable applied anatomy.

Head & Neck
All necessary details of scalp, face, orbit, eye ball, ear, triangles of neck, muscles concerned, pharynx and larynx, oral cavity and tongue, tonsils, adenoids, oesophagus, trachea, all blood vessels of head and neck, details of nerves of the region, sympathetic and para sympathetic components, cranial nerves, skull, cranial cavities and cervical vertebrae – relations and systemic outlay of various parts and structure -- necessary and applicable applied anatomy.

Brain & Spinal cord
Meninges -- Parts of brain -- external features -- internal features -- various ascending and descending tracts -- neural connexions – specialized areas of brain and their functions – ventricles of brain – cranial nerves and their connexions – blood supply – relations and systemic outlay of various parts and structure necessary and applicable applied anatomy.

OSTEOLOGY
All bones of the human body with details of their parts, features, muscular attachments, markings, special features if any – general principles of ossification and details of important ossifications.

EMBRYOLOGY (General Embryology)
Sperm and ova formation – fertilisation – formation of embryo – early development of embryo – bilaminar and trilaminar discs – placenta and details – folding of embryo – details of general embryology – necessary applied anatomy.

HISTOLOGY (General Histology)
Tissues and their classification – microscopic features of epithelial, connective, muscular and nervous tissues -- necessary applied anatomy.

SURFACE ANATOMY
Surface markings of structures of upper and lower limbs.

RADIOLOGICAL ANATOMY
Basic study of x-rays and normal details as seen – plain x-rays and contrast x-rays – reading of appearance of normal structures – basics of CT, MRI and ultrasonology.

II. Dissertation Work:

During the first academic year itself, the student will plan about an appropriate dissertation and commence requisite work for the same.
The scheme of events on the proposal and approval of topic for dissertation shall be as follows:
The student

- shall submit appropriate proposals for a planned dissertation after 9 months of joining the course (i.e., by December of the said academic year of joining);
- shall submit the said proposals to the scrutiny committee of the department and satisfy the committee in approving a particular topic;

- shall submit a proper synopsis on the chosen topic of dissertation, with details of proposed methodology, by the end of the first academic year.

The Head of the Department, on appropriate satisfaction of the topic for dissertation and synopsis, shall inform the University about the details of the topic.

SECOND ACADEMIC YEAR

In the second academic year, the following should be included:

- Requisite and Necessary Clinical Postings
- Involvement in undergraduate teaching programmes of the department

A. Clinical postings

The student will attend a clinical posting of the following areas. The student will only observe the procedures followed in the concerned areas / specialities; he / she will not be actively involved in the activities of the concerned area / speciality.

The clinical postings will only be in the forenoon sessions and by the timings specified by the concerned department in the forenoons. The student will attend the parent department in the afternoons.

General Surgery	----	1 month
Radiology	-----	2 months
Neurology	-----	1 month

B. In the parent department of Anatomy,

I. Areas of study

EMBRYOLOGY (Special & Systemic Embryology)
Details of growth and development of organs and organ systems – probable congenital anomalies – specialisation and differentiation.

HISTOLOGY (Special & Systemic Embryology)
Microstructural details of viscera of various organ systems of the body – microstructural details of special areas.

HISTOLOGY (Slide preparation and Staining work)
Details of procuring tissue specimens – Processing and preserving of given tissue – Fixation, definition and types, effects and methods, parameters of a fixative, commonly used fixatives, advantages and disadvantages -- types of wax and their choice – steps of paraffin processing – vacuum embedding and cryo sectioning -- Section cutting and slide preparation – Microtomes, types, parts and functioning – Knives, honing and stroping – methods of sectioning – sectioned tissue to be mounted and fixed on a slide -- staining of paraffin sections with regular and special stains – chemistry of stains – progressive and regressive staining –basic staining – common staining – staining and its effect on various cellular and histological components -- principles of neurohistology – immunohistology – autoradiography and vital staining.

ANATOMICAL TECHNIQUES

Imporatant and relevant anatomical techniques including specimen mounting, specimen preservation, corrosion casting, plastrination, model making.

RADIOLOGICAL ANATOMY AND SURFACE ANATOMY

Details of x-rays – reading of anatomical phenomena in x-rays (eg: ossification and fusion lines, appearance or non-appearance of ossification centres etc) – reading and reasoning of CT,MRI and scan pictures – cross sectional anatomy.

Surface marking of important structures and viscera of the body, especially that of the trunk.

GENETICS

Definition and explanation of genetics and genetic patterns – Structural components related to genetics – Theories and proponents of various genetic concepts -- Chromosomes and aberrations – genes, mutation and aberrations – Eugenics – Population genetics – Commonly encountered genetic abnormalities.

II. Participation in histological and embalming work

The student, in the second academic year, shall get involved in histological slide preparations. He/She also shall learn operative principles and techniques of instruments used in histology laboratory.

III. Participation in embalming work

The student shall learn principles and methodology of embalming. The student, at the discretion of the Head of the department, may also be made to actually perform embalming under necessary supervision.

IV. Other work

The remaining time shall be spent in requisite proportions in taking undergraduate classes and Research activity of the student. The student shall also get acclimatised with computer operations and applications as relevant to study, research and teaching modalities.

However, the student, in the second academic year,

- shall get involved in the Under graduate teaching activities of the Department.
- shall attend the theory and practical UG classes conducted by the senior faculty
- shall attend necessary workshops on Teaching Methodology and Research Methodology
- shall attend the horizontal and vertical integration programmes of the department

THIRD ACADEMIC YEAR

In the third academic year, the student

- shall be involved in the Under-graduate teaching activities of the Department including the integration programmes;
- shall be involved in the maintenance activities of the department including embalming of cadavers, specimen making and museum and specimen maintenance;
- shall present seminars, discussions and pedagogy sessions;
- shall submit the completed dissertation at the end of 6 months of third academic year.

The student shall work on specimen preparation and maintenance including corrosion casts, plastrination, mounting and museum maintenance. Participation in various kinds of work of the department shall be similar to the second academic year.

PATTERN OF EXAMINATION

There shall be three theory papers and three practicals at the end of the third academic year.

THEORY

PAPER I -- GROSS AND REGIONAL ANATOMY

Includes general anatomy, gross anatomy of all regions of the body, relations and outlay of parts and structures, relevant sub-areas of anatomy like osteology, angiology, myology and arthrology, concerned surface marking and overall systemic anatomy.

PAPER II -- EMBRYOLOGY AND GENETICS

Includes general and systemic embryology of all parts of the body, various organs and their development, factors controlling and affecting growth and development, prevention and application, basic genetics and its applications, genetic and chromosomal aberrations, commonly encountered genetic abnormalities.

PAPER III -- HISTOLOGY, NEURO-ANATOMY AND ANATOMICAL TECHNIQUES

Includes histological techniques, museum techniques and embalming, parts and components of neurological system including central nervous system, peripheral nervous system and autonomic nervous system.

PRACTICALS

The practical examination and the viva voce shall be held in two days.

PRACTICAL I – DISSECTION

Any one area of the human body to be dissected individually by the candidate; the area shall be decided and allotted by the board of examiners.

PRACTICAL II -- HISTOLOGY

Shall be subdivided into i) SPOTTERS --- 25 slides
ii) EMBEDDING
iii) SECTION CUTTING
iv) STAINING OF GIVEN SLIDE

PRACTICAL III -- PEDAGOGY

The candidate shall be instructed to present a full-fledged hypothetical class on a given topic/ area as given by the board of examiners.

VIVA VOCE

A complete viva covering gross anatomy specimens, embryology models and charts, bones, radiological pictures, genetics charts and models.

MARKS ALLOCATION AND DISTRIBUTION

THEORY -- THREE PAPERS each of THREE HOURS duration

PAPER I Maximum marks 100
Essay answers 02 --- 2 x 15 == 30
Short answers 10 --- 10 x 05 == 50
Brief answers 10 --- 10 x 02 == 20

PAPER II Maximum marks 100
Marks distribution as in Paper I

PAPER III Maximum marks 100
Marks distribution as in Paper I

TOTAL 300

PRACTICALS

PRACTICALS I Maximum marks 100
(Dissection and concerned discussion)

PRACTICALS II Maximum marks 100
Spotters 25 x 2 ----- 50
Staining ------ 20
Section cutting ----- 20
Embedding ----- 10

PRACTICALS III Maximum marks 050

TOTAL 250

VIVA VOCE Maximum marks 050

DISSERTATION No marks APPROVED / NOT APPROVED

MARKS QUALIFYING FOR A PASS

Component of examination		Maximum marks	Qualifying marks
Theory	3 x 100	300	150
Practicals	2 x 100 1 x 050	250	125
Viva voce	050	050	No minimum
AGGREGATE		600	300

M.Sc. PHYSIOLOGY

M.Sc. Post Graduate Degree Course in Physiology (Non-Medical) in the Faculty of Medicine.

INTRODUCTION

The M.Sc Physiology (Non-Medical) degree course is a three year programme designed to train students to acquire an overall understanding of the functioning of the human body and its relevance to clinical sciences.

At the end of the three year programme, the student shall be able to

1. Take part in teaching schedules of physiology
2. Provide essential facts of the subject in relation to the functioning of the different organ systems and its clinical significance.
3. Acquire a good knowledge and skills in practical physiology so as to enable oneself in guiding and teaching the undergraduates.
4. Familiarize with the instruments available in the department so as to enhance ones research capabilities in basic sciences.
5. Acquire computational and statistical skills.

COURSE CONENT AND PATTERN OF THE COURSE

General Instructions

1. The student shall be a full time student.
2. The student shall be under the Head of the Department and day to day allocation of work will be at the discretion of the head.
3. Instructions regarding log book, record book, dissertation work and attendance should be followed as per regulation given.
4. Will attend all the departmental academic activities.

First Academic year:

The student will follow the pattern of MBBS students for theory, practical, discussions, seminars and Internal Assessment tests.

Theory	Hours
General Physiology	16
Muscle	10
Blood	22
GI System	18
Renal	20
Respiration	16
CVS	28
CNS	38
Special Senses	18
Seminar and Internal Assessment tests	102
Practicals	96
Group Discussion	96
Total	480

Second Academic Year:

Three months CLINICAL POSTING in the forenoon session.

- Medicine - 1 Month
- Cardiology - 15 days
- Neurology - 15 days
- Medical gastroenterology - 15 days
- Nephrology - 15 days

Note: The students will be in the parent department in the afternoon session.

Schedule in the Department of Physiology:

- Will involve in Undergraduate teaching of theory and practical.
- Will attend all theory classes taken for undergraduates by the senior faculties.
- Will attend workshops on teaching methodology, research methodology and biostatistics.
- At the end of 6 months of the second year, will submit the Synopsis of the topic and the dissertation to the University.
- Will work on a small project during the beginning of second year.

Third Academic Year:

- Will be involved in teaching theory and Practicals and conduct group discussion for the Under Graduate Students, under the supervision of the senior faculties.
- Post Graduate Practical (amphibian, isolated organ, instrumentation)
- Group Discussion
- Seminar and Internal Assessment

PATTERN OF EXAMINATION

At the end of the third academic year the students would have to undergo an University Examination comprising of

- Three papers in theory
- Practicals including Pedagogy and Viva Voce.

THEORY EXAMINATION

Paper – I
General Physiology
Body fluids
Renal Physiology
Blood
Recent Advances in Physiology

Paper –II
Cardio vascular system
Respiratory system
Environmental Physiology
Gastrointestinal system

Paper-III
Central nervous system
Special Senses
Endocrine and Reproduction

MARK ALLOCATION FOR THEORY

1. Each paper 3 hour's duration.
2. Maximum Marks (Each Paper) – 100
3. Distribution of Marks: (each paper)

Questions	**Number**	**Marks(each)**	**Total**
Essay	2	15	30
Short Answers	10	5	50
Brief Answers	10	2	20
			100

PRACTICAL EXAMINATION
Amphibian:

Recording of nerve muscle preparation

1. Simple Muscle curve
2. Effect of two successive stimuli
3. Effect of repeated stimuli
    a. Fatigue
    b. Tetanus
4. Nerve conduction velocity
5. Free load and after load
6. Effect of temperature on muscle contraction

Recording of amphibian heart

1. Normal cardiogram
2. Effect of temperature on ventricles and sinus venosus
3. Effect of stannous ligature
4. Demonstration of properties of cardiac muscle
5. Effect of vagal stimulation on the heart
6. Effect of drugs and ions on isolated heart preparation

Recording of isolated mammalian experiments

1. Effects of drugs on intestinal motility
2. Effect of drugs on uterus contraction

Discussion of mammalian charts

1. Blood pressure recording and respiration
2. Changes in blood pressure and respiration following hemorrhage
3. Effect of vagal stimulation on blood pressure and respiration
4. Effect of drugs on blood pressure and respiration
5. Effect of carotid ligature on blood pressure and respiration
6. Effect of splanchnic nerve stimulation

Hematology

1. RBC count
2. WBC count
3. Platelet count
4. Arneth index
5. Absolute Eosinophil count
6. Reticulocyte count
7. Hemoglobin estimation
8. Blood grouping
9. Bleeding time and clotting time

Clinical examination

1. General examination
2. Cardiovascular system
3. Respiratory system
4. Central nervous system
    a. Motor
    b. Sensory
    c. Reflexes
    d. Cerebellar function tests

Demonstration

e. Electrocardiogram
f. Spirometer
g. Perimeter
h. Nerve conduction velocity
i. Heart rate variability
j. Evoked potentials
k. Stethography
l. Respiratory efficiency tests

Pedagogy:

Micro teaching on a given topic given by the examiners.

Viva voce:

PRACTICAL EXAMINATION:

Allocation of Marks:

	Max	**Min**
Amphibian	40	
Isolated organ	40	
Mammalian	20	
Hematology	40	
Clinical Examination	30	
Demonstration	30	
Pedogogy	50	
Practicals-Total	250	125
Viva Voce	50	No min.
Dissertation	Approved/Not Approved	

MARKS QUALIFYING FOR A PASS

EXAMINATION	MAXIMUM MARKS	QUALIFYING MARKS
Theory	3x100 = 300	150
Practicals	250	125
Viva voce	50	No minimum
Aggregate	600	300

Theory schedule for M.Sc

Serial Hours	Topic Hours	System
		I. INTRODUCTION
1.	1.	Structure and functions of cell organells
2.	2.	Tissues, organs, systems and Homeostasis
3.	3.	Membrane transport
4.	4.	Membrane potential and action potential
5.	5.	The body fluid compartments
		II. BLOOD
6.	1.	Composition, function, properties of blood plasma proteins and their functions
7.	2.	RBC – Structure, functions, life span, Haemoglobin
8.	3.	Erythropoiesis - Controlling factor
9.	4.	Destruction of RBC, Jaundice, anaemia and polycythemia
10.	5.	ESR, PCV, Blood group
11.	6.	Leucopoiesis, physiological and pathological variation
12.	7.	WBC – structure, functions, immunity and allergy
13.	8.	Macrophage – Reticuloendothelial system
14.	9.	Platelets, structure, functions and variations
15.	10.	Hemostasis, clotting factors, Antocoagulants
16.	11.	Intrinsic and Extrinsic clotting mechanism
17.	12.	Lymphatic system, oedema, hydration

Serial Hours	Topic Hours	System
		III. GASTRO-INTESTINAL TRACT
18.	1.	Introduction, classification of food – The alimentary tract
19.	2.	Characteristic of gastro intestinal wall and electrical activity Nervous and hormonal control of GIT
20.	3.	Secretory functions of GIT Salivary gland
21.	4.	Gastric gland
22.	5.	(1) Pancreatic secretion (2) Secretions of small and large intestine
23.	6.	Mixing of food (1) Ingestion (2) Mastication (3) Swallowing
24.	7.	Motor functions of stomach
25.	8.	Absorption of carbohydrate, proteins, fat Structure of villi Blood supply of intestine
26.	9.	Liver
27.	10.	Movement of intestine Ulcer
28.	11.	Defecation reflex, Large intestine
		IV. RESPIRATION
29.	1.	Introduction Structure of Respiratory system
30.	2.	Mechanism of Respiration Respiratory movements
31.	3.	Intra pulmonary pressure Intra pleural pressure Collapsing tendency of lungs

Serial Hours	Topic Hours	System
32.	4.	Surface Tension Elastic fibres Surfactant Air of the lungs
33.	5.	Volumes and capacities Dead space
34.	6.	Composition and partial pressure of gases in atmospheric air, alveolar air, expired air, diffusion of gases in lungs
35.	7.	o2 transport in the Blood
36.	8.	o2 transport in the Blood
37.	9.	Neural control of respiration
38.	10.	Chemical control of respiration and non-chemical control
39.	11.	Hypoxia, cyanosis and o2 therapy
40.	12.	Dysbarism, Ascend to high altitude, Mountain sickness
41.	13.	Aviation, space & deep sea Artificial respiration
42.	14.	Respiratory adjustments in health and artificial respiration
		V CARDIO VASCULAR SYSTEM
43.	1.	Structure and properties of cardiac muscle and heart
44.	2.	Pulmonary and systemic circulation of blood vessel
45.	3.	Rhythmic excitation of the heart and its control
46.	4.	Abnormal sinus rhythms - Trachycardia - Brady cardia - Sinus Arrhythmias - Fibrillation (Ventricular & Atrial) - Cardiac arrest

Serial Hours	Topic Hours	System
47.	5.	Cardiac cycle 1. Mechanical Event
48.	6.	ii. Hear sounds iii. Dynamic changes
49.	7.	iv. ECG ECG – leads a. Bipolar limb leads b. Chest leads c. Augmented unipolar limb leads
50.	8.	Cardiac output i. Heart rate ii. Stroke volume and regulation
51.	9.	Methods of measuring cardiac output Venous return and factors affecting venous return
52.	10.	Blood pressure, method of measuring BP
53.	11.	BP regulation
54.	12.	Vasommotor centres, cardio acceleratory and cardio inhibitory centre
55.	13.	Effect of CVs on Exercise
56.	14.	Blood flow or blood supply i. Coronory circulation ii. Cerebral circulation iii. GIT iv. Liver v. Kidney vi. Muscles etc.
57.	15.	Local and humoral regulation of blood flow
58.	16.	Cardiac failure
59.	17.	Cardiac shock and treatments

VI EXCRETION

60.	1.	Introduction and functional anatomy of kidney structure of nephron
61.	2.	Renal blood flow and pressure

Serial Hours	Topic Hours	System
62.	3.	Mechanism of glomerular filtration and its measurements
63.	4.	Absorptive and secretory functions of the tubules
64.	5.	Renal and associate mechanisms for controlling extra cellular Fluid and sodium concentration (Counter-current mechanisms and dilurectics)
65.	6.	Renal regulation of blood volume and ECF volume
66.	7.	Juxtra – glomeruular apparatus Renin – Angiotensin mechanism Renal functional test
67.	8.	Regulation of pH, water and Electrolyte balance
68.	9.	Respiratory regulation of acid base balance
69.	10.	Innervation of urinary bladder and micturition reflex
70.	11.	Renal diseases and functions of kidney Hormones of the kidney, produced by kidney Action on kidney
71.	12.	Artificial kidney
		VII MUSCLE
72.	1.	Introduction and classification of muscle Microscopic structure of skeletal muscle
73.	2.	Contraction of skeletal muscle Rigor mortis
74.	3.	Neuro-muscular junction Myasthenia Gravis
75.	4.	Excitation – contraction coupling and theories

Serial Hours	Topic Hours	System
76.	5.	Isometric in contraction and isotonic contraction – properties of Skeletal muscle
77.	6.	Contraction and Excitation of smooth muscle
78.	7.	Cardiac muscle properties and main difference between these three muscle
		VIII. THE CENTRAL NERVOUS SYSTEM
79.	1.	Introduction to central nervous system Neuron Classification of nerve fibres and degeneration
80.	2.	Neuroglial cells – Receptors
81.	3.	Action potential, resting membrane potential and conduction
82.	4.	Synapsis – Properties
83.	5.	Neuro – transmitters
84.	6.	Reflex – classification properties
85.	7.	Muscle spindle – Monosynaptic reflex
86.	8.	Cross-section of spinal cord, Ascending tracts of spinal cord
87.	9.	Descending tracts of spinal cord
88.	10.	Hemi-section of spinal cord
89.	11.	Basal ganglia
90.	12.	Cerebellum
91.	13.	Thalamus
92.	14.	Hypothamalus
93.	15.	Reticular formation, aleep, EEG
94.	16.	Cerebral cortex

Serial Hours	Topic Hours	System
95.	17.	CSF, Ventricular system of brain
96.	18.	Autonomic Nervous system
97.	19.	Posture and equilibrium, Higher functions of brain
		IX. SPECIAL SENSES
98.	1.	EYE: Basic principles of light and colour
99.	2.	Image formation in the eye, including defects of vision Colour vision – colour blindness
100.	3.	Visual pathway and lesion at various levels
101.	4.	EAR: Sturcture and function of external auditory meatus, ear drum, middle ear and inner ear
102.	5.	Auditory pathway, Deafness and Auditory cortex
103.	6.	Taste
104.	7.	Smell
		X ENDOCRINOLOGY
105.	1.	Introduction to hormones, types of hormones, mechanism of action of hormones, definition of paracrine, endocrine and autocrine
106.	2.	Regulation of endocrine function by hypothalamus and pituitary Gland
107.	3.	Adnohypophyses & Neurohypophyses
108.	4.	Mechanism of action of hormones including receptor ling and Inter action, second messenger concept, role of cellular calcium
109.	5.	Thyroid gland and hormones
110.	6.	Actions of thyroid hormones and applied physiology

Serial Hours	Topic Hours	System
111.	7.	Structure of bone and functions of calcium
112.	8.	Parathyroid hormones clacitonin, parathormone vitamin D (Calcium – phosphate metabolism)
113.	9.	Endocrinepancreas Insulin – Glucogon Diabetes Mellitus
114.	10.	Adrenal cortex – Gluco corticoide
115.	11.	Adrenal cortex – mineralo corticoide & sex hormones
116.	12.	Adrenal medulla
117.	13.	Local hormones (Nitric oxide) Gastro-intestinal hormones, thymus
118.	14.	Endocrine function of kidney and pineal gland
		XI REPRODUCTION
119.	1.	Sex determination and abnormalities of differentiation
120.	2.	Female reproductive tract Functions of ovaries Female sex hormones
121.	3.	Development of gonads and secondary sexual characateristics and onset of puberty in female
122.	4.	Endocrine regulation of menstrual cycle
123.	5.	Male reproductive tract Spermatogenesis
124.	6.	Male sex hormones Physiology of pregnancy and pregnancy test
125.	7.	Role of placenta in the physiology of foetus and new born
126.	8.	Physiology of lactation and contraception

M.Sc. BIOCHEMISTRY

M.Sc Post-graduate degree course in Biochemistry (Non-Medical) in the Faculty of Medicine

COURSE CONTENT & SYLLABUS

INTRODUCTION:

The M.Sc Biochemistry (Non-Medical) degree course is a three year programme designed to train students to acquire an overall understanding of the structure of human biochemistry & cellular processes and to facilitate competence in the subject of Biochemistry so as to assist in teaching.

At the end of the three year programme, the student shall be able to

1) Take part in teaching schedules of Biochemistry;
2) Provide essential facts of the subject with relation to the different and various parts of the human biochemistry and cellular processes and biochemistry in relation to disease;
3) Have theoretical and practical experience of performing various biochemical techniques / tests and practical
4) Have knowledge of operating, handling and maintaining equipments and supervise the working of a student Lab and practical lab

ELIGIBILITY TO ENROL, DURATION OF THE COURSE, COMMENCEMENT OF COURSE AND EXAMINATION

Details as scheduled in the Regulations of The Tamilnadu Dr.M.G.R. Medical University, M.Sc Non-Medical Three Year Degree course in Non-Clinical subjects under the Faculty of Medicine, Common to all subjects

COURSE PROGRAMME

The Course of study shall be for a period of three years. Candidates undergoing the programme shall be full time students.

The course comprises three academic years with the student undergoing necessary training in each of these years in consecutive order.

First Academic Year – The student acquires basic knowledge in all areas of biochemistry in conformity with the curriculum and syllabus of MBBS course;

Second Academic Year – The student acquires higher levels of knowledge and gets involved in all areas of day-to-day activities of the Department of Biochemistry ; Greater emphasis shall be placed on acquiring teaching and pedagogic skills with regard to different areas of Biochemistry , and with an ultimate objective of teaching and training under-graduate medical students;

Third Academic Year – The student acquires skills of conducting basic research in the subject; also gets involved in various teaching, procedural and maintenance activities of the Department, thus completing a full-fledged training.

EXAMINATION

- The student shall be eligible to take up the Regular University Examinations on completion of three years of study, as detailed in the course programme and course content.
- The Examination will consist of THREE THEORY PAPERS, THREE PRACTICALS and VIVA VOCE.

PASSING IN THE EXAMINATION

The candidate shall secure a minimum of 50% in the theory papers, 50% in the practicals and 50% in the aggregate to become eligible for a pass.

Dissertation does not carry any marks. However, the dissertation will be evaluated by the Board of Examiners and declared to be APPROVED / NOT APPROVED.

A candidate failing in either theory or practicals will have to reappear for theory, practicals and viva voce to be able to clear the examination in subsequent attempt. However, the dissertation, if approved, need not be submitted again.

A candidate whose dissertation is not approved by the board of examiners will have to resubmit the dissertation (after necessary rectification and compliance of errors pointed out by the board of examiners), duly forwarded by the Head of the Department and Head of the Institution. The theory and practical results of such a candidate will be kept withheld. The said results shall be declared only after the approval of the dissertation.

COURSE CONTENT AND PATTERN OF THE COURSE

General principles:

1. The student is a full-time student.
2. The student is under the Head of the Department and day-to-day allocation of work will be at the discretion of the Head.
3. The student shall maintain separate practical record related to basic biochemistry experiments, biochemical techniques and instrumentation and advanced analytical work.
4. The student shall also maintain a log book of day to day analytical and academic activities carried out in the department during the second and third academic years.
5. The record and log books shall be subjected to periodical scrutiny by the Head of the Department or any other member of faculty assigned there of.

FIRST ACADEMIC YEAR

The student will follow pattern of MBBS (I MBBS syllabus of Biochemistry for theory, practical, orals, discussions and seminars.

I. Areas of study

will include as per the syllabus for the written theory paper I

II. Dissertation Work:

During the first academic year itself, the student will plan about an appropriate dissertation and commence requisite work for the same.

The scheme of events on the proposal and approval of topic for dissertation shall be as follows:
The student

- shall submit appropriate proposals for a planned dissertation after 9 months of joining the course (i.e., by December of the said academic year of joining);
- shall submit the said proposals to the scrutiny committee of the department and satisfy the committee in approving a particular topic;
- Shall submit a proper synopsis on the chosen topic of dissertation, with details of proposed methodology, by the end of the first academic year.

The Head of the Department, on appropriate satisfaction of the topic for dissertation and synopsis, shall inform the University about the details of the topic.

SECOND ACADEMIC YEAR

In the second academic year, the following should be included:

- Will be posted for a requisite period in the clinical biochemistry laboratory to carry out analytical work independently
- Involvement in undergraduate teaching programmes of the department

A. Laboratory Work
The laboratory work includes collection of samples for patients attending Outpatient department of the hospital and all types of analytical work of the department.

B. In the parent department of Biochemistry:

Areas of study

- Clinical Biochemistry & Instrumentation And Techniques And Management Of Clinical And Student Laboratory
- Participation in Seminars, workshops, journal clubs, symposium and CME programmes organised by the department
- The remaining time shall be spent in requisite proportions in taking undergraduate classes and Research activity of the student. The student shall also get acclimatised with computer operations and applications as relevant to study, research and teaching modalities.

However, the student, in the second academic year,

- Shall get involved in the Under-graduate teaching activities of the Department.
- shall attend the theory and practical UG classes conducted by the senior faculty
- shall attend necessary workshops on Teaching Methodology and Research Methodology

- shall attend the horizontal and vertical integration programmes of the department

THIRD ACADEMIC YEAR

In the third academic year, the student

- shall be involved in the Under-graduate teaching activities of the Department including the integration programmes;
- preparation of reagents for UG practical lab and necessary reagents for analytical work
- shall present seminars, discussions and pedagogy sessions;
- Shall submit the completed dissertation at the end of 6 months of third academic year.
- Participation in various kinds of work of the department shall be similar to the second academic year.

COURSE BASIS

I. WRITTEN -- PAPER I

PHYSICAL AND ORGANIC ASPECTS OF BIOCHEMISTRY, MEMBRANES, INSTRUMENTATION & LABORATORY TECHNIQUES, BIOSTATISTICS

A. PHYSICAL AND ORGANIC ASPECTS OF BIOCHEMISTRY AND MEMBRANES

Electrolytic dissociation, mass law, acids and bases, pH, buffers, surface tension, viscosity, Colloidal State Donnan equilibrium, osmosis, colloids, diffusion, dialysis, applications to biological systems, Hydrogen bonding, hydrophobic interactions and ionic bridges, Determination of molecular weights.
Prokaryotic and eukaryotic cells. Structure of eukaryotic cells – sub cellular organelles, and their functions.

Sub-cellular fractionation – density gradient centrifugation, differential centrifugation, markers for each organelle and fraction

Biomembrane and its structure, fluid mosaic model and assembly of membranes
Properties of biological membranes artificial membranes and liposomes, Transport across membranes – active, facilitated and passive.
Transport mechanisms – ion channels including gated channels, carrier proteins, glucose transporters (GLUT), active transporters, symporters and antiporters.
Cell interactions and adhesion – types of junctions : tight junctions and gap junctions.
Surface glycoproteins and cell surface labeling – ABO blood groups, major histo-compatibility complex (MHC), Adhesion molecules

Carbohydrates : Classification of carbohydrates, structure, configuration, reactions and functions of pentoses, hexoses, oligosaccharides and polysaccharides (including glycosaminoglycans, glycoproteins)

Lipids: Classification, Structure, physical and chemical properties of lipids

Fatty acids, Saturated and Unsaturated fatty acids Polyunsaturated fatty acids, triacylglycerols, Phospholipids, glycolipids, lipoproteins, steroids, Eicosanoids

Aminoacids : Classification of amino acids, their physical and chemical properties and general reactions, peptides, Modified amino acids Amino acids as buffers, amino acid titration, zwitterions and isoelectric point, Dissociation constant

Proteins : Classification of proteins, structure, properties and function; hemoglobin, myoglobin, collagen, elastin,
Relationship of function to the three dimensional structure of myoglobin, haemoglobin, collagen and elastin.
Biologically important Peptides Cross-links, hydrogen bonds, disulphide bonds, non-covalent and ionic bonds in peptides
Primary, secondary, tertiary and quaternary structure of proteins and elucidation of these

Nucleotides and Nucleic acids Chemistry of purine and pyrimidines nucleic acids, DNA structure and function, organisation of Chromatin, Role of histones in Chromatin formation.
Various types of RNA, their structures and functions, biologically important nucleotides and their derivatives, analogues of purines, pyrimidines, nucleosides and nucleotides and their clinical importance.

B. Laboratory techniques: Principles, Applications & Instrumentation

Centrifugation, Ultracentrifugation.

Radio Immuno Assay : Radioactivity, properties of radionuclides and measurement of radioactivity Techniques, Autoradiography, GM counter, Scintillation counting.
Immuno-radiometric assay (IRMA), Stable isotopes and mass spectrometry.

Colorimetry, Beer- Lambert's law, Spectrophotometry. Reflectance photometry. automated techniques, semi- and random autoanalysers, flow cytometer,
Flame emission photometry, Atomic absorption spectrophotometry.
Flurometry. Phosphorescence, chemiluminescence and bioluminescence Nephelometry.
Turbidimetry.
Direct vision spectroscope.

Electrochemistry- chemical sensors, potentiometry, ion selective electrodes, optical chemical sensors, enzyme electrodes and enzyme immobilization.
Osmometry.

Electrophoresis – Paper, Agarose Gel, PAGE, SDS - PAGE, iso-electric focusing.

Chromatography – Column, Paper, TLC, GLC, HPLC, Gel filtration, Ion exchange and their applications.

Immunochemistry : Principles of immunochemistry. immunoelectrophoresis. ELISA techniques, Blotting techniques.

Automation in laboratory and clinical chemistry.

Principles of laboratory analyses and safety:
Units of measurement, International system of units in laboratory medicine.
Conversion from conventional units to SI units, IFCC and IUPAC system recommendations, Reference materials Reagent grade water production.

C. BIOSTATISTICS

Basic biostatistic principles as applied to health sciences ::Mean, Standard deviation, Standard Error of Mean, tests of significance (confidence interval student's t test, chi-square test, ANOVA), correlation coefficient, probability.

Selecting an analytical method, Evaluation of an analytical method, Evaluation of a diagnostic test.

II. WRITTEN -- PAPER II :

ENZYMES, INTERMEDIARY METABOLISM, AND INBORN ERRORS OF METABOLISM AND NUTRITION

A. ENZYMES

Enzymes : Nomenclature, Classification**,** Chemistry, isolation, purification and characterization, General Properties, Co Enzymes and Metal activated enzymes, Metallo-Enzymes, mechanisms of action, factors influencing enzyme activity, Michaelis- Menten constant, Kinetics of enzyme action, Km Value and its significance, influence of activators and enzyme inhibitors, regulation of enzyme activity Allosteric enzymes, isoenzymes, clinically important enzymes and role of enzymes in clinical medicine, enzyme therapy, immobilized enzymes, serine proteases.

B. INTERMEDIARY METABOLISM AND ERRORS OF METABOLISM

Vitamins :Chemistry, Structure, Functions, natural occurrence, dietary sources, daily human requirements and deficiency manifestations of water soluble and fat soluble vitamins , hyper-vitaminosis, antivitamins, assays of vitamins and screening of vitamin status in humans.

Bioenergetics and biological oxidation :
The role of ATP and other high-energy phosphates, Biologic oxidation.
The respiratory chain. Oxidative phosphorylation – theories, inhibitors, uncouplers.
Mitochondrial diseases.

Carbohydrate metabolism : Digestion and absorption, Glycolysis, Rapaport-Leubering cycle, HMP shunt, Glycogenesis and glycogenolysis, TCA cycle, Uronic acid pathway, Gluconeogenesis and their regulation, metabolism of fructose and Galactose, regulation of blood glucose, Metabolism of glycosaminoglycans and Glycoproteins and associated disorders. hypoglycemia, hyperglycemia, renal glycosuria, and diabetes mellitus, and GTT, inborn errors of carbohydrate metabolism, disorders of fructose metabolism. lactose intolerance, and glycogen storage diseases, Metabolism of alcohol

Lipid metabolism : Digestion and absorption, Fatty acid synthesis and elongation, synthesis of unsaturated fatty acids, oxidation of fatty acids, metabolism of Ketone bodies and unsaturated fatty acids, essential fatty acids, metabolism of Eicosanoids and their

biological role, metabolism of triglycerides, Phospholipids, sphingolipids and cholesterol, Compounds derived from cholesterol. fatty liver, lipotropic factors, metabolism of lipoproteins, inborn errors of lipid metabolism, Metabolism in adipose tissue (including brown adipose tissue), disorders of lipid metabolism, Lipid storage disorders Obesity. Metabolic adaptations in starvation and obesity.

Proteins : Digestion and absorption of proteins, gamma glutamyl cycle, catabolism of amino acids, ammonia production, Nitrogen balance, inter-organ transport of amino acids, Urea cycle and associated disorders, Hyperammonemia.
Catabolism of carbon skeleton of amino acids, Biosynthesis of nonessential amino acids. Degradation of individual amino acids, creatinine and creatinine metabolism, biogenic amines, Specialized products formed from amino acids. Neurotransmitters, polyamines, biologically important peptides, plasma proteins, paraproteins, aminoacidurias Inborn errors of amino acid metabolism

Integration of metabolism and metabolic adaptation during fed state and starvation

Metabolism in specialized tissues: Erythrocytes, Liver, Muscle, Central nervous system, Adipose tissue., Lens, Kidney.

Metabolism of Haem : Biosynthesis, Disorders associated with defects in biosynthesis. Degradation of haem, Metabolism of Bilirubin, Disorders associated with abnormalities in the metabolism of Bilirubin, Laboratory diagnosis in these disorders
Abnormal haemoglobins and haemoglobinopathies. Thalassemia, Sickle Cell anemia, Methhemoglobinemia

Biochemical and molecular aspects of processes in the body :
Muscle contraction, Nerve conduction, Coagulation of blood.

Metabolism of minerals : Sodium, Potassium, Calcium, Phosphorus, Magnesium. Copper, Zinc, Iron , Chromium, Selenium, Cobalt, Manganese, Other trace minerals. Inborn errors of mineral metabolism.

Metabolism of xenobiotics and detoxification. Environmental hazards, Biochemical aspects of environmental hazards – occupational hazards. (exposure to lead and organophosphorous compounds), hazards due to modern industrialization and noise pollution

C. NUTRITION

Free radicals and anti-oxidants
Nutrition: Energy metabolism, basal metabolic rate and specific dynamic action, Energy requirements, Macronutrients and their roles, Balanced diets, biological value of proteins, essential amino acids, Dietary fibre dietary deficiencies, supplementary relationship among proteins, dietary requirements in the elderly, diabetes mellitus, etc, parenteral nutrition, Disorders of nutrition (protein malnutrition and protein energy malnutrition), Biochemical assessment of nutritional status, Laboratory diagnosis of nutritional disorders, National Nutrition Programmes

III. WRITTEN --- PAPER III :

MOLECULAR BIOLOGY, CLINICAL BIOCHEMISTRY, ENDOCRINOLOGY, IMMUNOLOGY AND RECENT ADVANCES IN BIOCHEMISTRY

A. MOLECULAR BIOLOGY

NUCLEIC ACIDS : Metabolism of purines, Disorders associated with abnormalities in the metabolism of purines, Primary & Secondary Gout, Metabolism of pyrimidines, Disorders associated with abnormalities in the metabolism of pyrimidines.
Nucleotide analogues in chemotherapy.

MOLECULAR BIOLOGY & GENETICS : Organisation of nucleosomes, chromatin & chromosome, Histones, Structure & Types of DNA & RNA, Mitochondrial and plasmid DNA, Eukaryotic & Prokaryotic DNA replication, DNA damage and repair, Eukaryotic & Prokaryotic RNA synthesis and processing, post transcriptional modifications, Mutation, Operon concept, gene rearrangement, gene amplification and transposons, gene-protein interaction, helix turn helix motif, zinc finger motif and leucine zipper motif.
Signal peptides, protein targeting and chaperones. protein synthesis and post-translational modifications of proteins, recombinant DNA technology and its application in medicine, restriction enzymes, Cloning and vectors – definition, characteristics of different vectors, genome library, cDNA library, DNA probes and blot transfer techniques, polymerase chain reaction, Reverse transcriptase PCR (RT-PCR), restriction fragment length polymorphism, and its applications**.** Fluorescent in-situ hybridization (FISH). Transgenic animals and RNA Interference, gene knockout animals, gene therapy DNA diagnostics – methods of identifying genes in human disease , The human genome project – sequencing of the genome and physical mapping Genetic maps.
Viral genetics – DNA and RNA viruses.

Cell cycle – concept of cell cycle, regulation of cell cycle, regulators – cyclins and their Regulators, extracellular regulators of cell cycle, Programmed cell death.

CARCINOGENESIS: Biochemical basis of cancer, oncogenes, tumor suppressor genes, tumor markers
Genetic cancer syndromes – familial breast cancer, familial adenomatous polyposis coli and retinoblastoma.
Inherited conditions that predispose to development of cancer (e.g., ataxia telangiectasia, xeroderma pigmentosum, Fanconi syndrome)
Basics of cytogenetics

B. CLINICAL BIOCHEMISTRY, ENDOCRINOLOGY, IMMUNOLOGY AND RECENT ADVANCES IN BIOCHEMISTRY

Collection of samples and preservation, pre-analytical errors in clinical biochemistry, standardization of laboratory methods, use of pooled serum, acquisition of standards for laboratory estimations, quality control methods, use of reference values, selection of methods for estimation of common analytes like blood glucose, urea, creatinine, plasma proteins, etc, automation in clinical biochemistry, microprocessors and use of computers in clinical biochemistry, statistical methods of analysis of results.

Immunology :
Immune system, immunoglobulins, monoclonal antibodies, antigen-antibody reactions, compelement system, cell-mediated immunity, mononuclear phagocytes, immunoassays, organ transplantation and histocompatibility, principles of immunization, immunological techniques in clinical chemistry.

Endocrinology :
General mechanism of action of hormones, evaluation of endocrine functions, hormones of hypophysis, hypothalamus, thyroid, parathyroid, pancreas, adrenals and gonads, hormones secreted by the gastrointestinal tract and kidneys, fetoplacental functions.

Metabolism of minerals:
Metabolism of calcium, phosphorous, magnesium, sodium, potassium and chloride – their relation to endocrinology. Trace elements and their metabolism.

Acid -base, water and electrolyte balance: Buffers of the body, Acidosis and alkalosis, interpretation of acid-base disorders

Function tests :
Investigation of kidney function, liver function, gastric function and pancreatic function. Renal calculi.
Tumor markers, cerebrospinal fluid analysis, aminotic fluid analysis and prenatal diagnosis of inborn errors of metabolism.

Clinical enzymology :
Estimation of serum enzymes like aspartate transaminase, alanine transaminase, alkaline, phosphatase, acid phosphatase, amylase, lactate dehydrogenase, creatine phosphokinase and gamma-glutamyl transferase.

Diagnostic tests : In diabetes mellitus, myocardial infarction, nephrotic syndrome, liver diseases.

LIST OF PRACTICALS

Qualitative analysis :

Reactions of glucose, fructose, maltose, lactose, sucrose and starch.

Reactions of albumin, casein and gelatin, peptones, color reactions of Aminoacids

Analysis of normal and abnormal constituents of urine.

Analysis of gastric juice

pH determination, photoelectric Colorimetry, spectrophotometry and paper and thin-layer chromatography (TLC)

Preparation of starch from potato and glycogen from rat liver and analysis of the products of their hydrolysis

Determination of iodine number, acid number and saponification value of fats.

Determination of nitrogen by Kjeldahl and Nessler’s methods.

Estimation of vitamin C by chemical methods.

Determination of enzyme activity and kinetics of acid phosphatase (potato) and liver Catalase.

Estimation of calcium and phosphorus in milk.

Agarose and polyacrylamide gel electrophoresis (PAGE) of serum proteins.

Separation of serum LDH isoenzymes and Alkaline phosphatase by polyacrylamide gel electrophoresis

Spectroscopy to identity haemoglobin derivatives

Chromatographic separation of sugars, amino acids

Quantitative analysis :

Estimation of plasma glucose, glycosylated haemoglobin, serum cholesterol, triglycerides, HDL cholesterol, Bilirubin, AST, ALP, ALT, gamma glutamyl transferase, sodium, potassium, chloride, bicarbonate, blood gases magnesium, calcium, phosphorus, copper, iron, iron binding capacity, LDH, creatinine kinase, amylase, acid phosphatase, G6PDH, cholinesterase, Ceruloplasmin, 24 hour urine protein and VMA, electrophoresis of serum proteins, Prothrombin Time & INR estimation, analysis of renal and gall bladder calculi, Estimation of ethanol in blood and urine, CSF analysis for glucose, protein ,chloride, Analysis of ascetic, pleural and other fluids for biochemical parameters

Detection of Bence-Jones protein in urine, Estimation of 17-ketosteroids and VMA in urine.

Demonstration:

Atomic absorption spectrometry, HPLC calculi analysis, autoanalysers, , enzyme-linked immunosorbent assays (ELISA), DNA extraction, Polymerase chain reaction, quantitative estimation of hormones.

PATTERN OF EXAMINATION :-

UNIVERSITY EXAMINATION WILL BE AT THE END OF THIRD YEAR

1. The Project Work which is to be submitted by candidate at least 6 months before the date of commencement of the theory examination.

2. Theory : Three theory papers - 100 Marks each 3 Hours duration each

Theory	Title	Duration	Marks
Paper – I	Physical and Organic	3 hrs.	100

aspects of Biochemistry,
Instrumentation and
Biochemical Techniques, Biostatistics

Paper – II	Enzymes, Intermediate Metabolism and Nutrition including minerals and vitamins homeostasis	3 hrs.	100
Paper – III	Molecular Biology, Clinical Biochemistry, Function tests, Endocrinology, Immunology, Recent Advances in Biochemistry	3hrs.	100
		Total	300

Distribution of Marks :

Each paper is to have Section A & Section B to be answered in separate booklets

Each section having

1	Essay - 15 marks	=	15 Marks
5	Short Notes - 5 marks each	=	25 Marks
5	Brief Answers - 2 marks each	=	10 marks

3. Practicals and Viva Voce / Oral.

Practicals shall have 2 components namely.

A) Practicals comprising of 3 exercises. Quantitative Analysis, Qualitative Analysis & Interpretation of Laboratory Results

B) Viva-voce with pedagogy of 15 – 20 minutes duration

Practical Examination

These examinations will be held over 2 days. They should consist of 3 practical

Practical I will consist of

1) General Biochemistry.

Qualitative identification of unknown amino acids or sugar

and confirmation by chromatography …60 marks 2) Identifying Normal & Abnormal constituents of urine …15 marks

Practical II will consist of

1) Quantitative estimation of an analyte and enzyme … 50 marks
Including separation of proteins by electrophoresis

2) Standardisation –

Preparation of a standard graph for a given analyte - 25 marks

3) Interpretation of laboratory results from 4 patient case studies on endocrine diseases, renal, cardiac, electrolyte and acid base disorders, mineral metabolism, inborn errors, analysis of body fluids, lipid profile, etc.

… 20 marks

Practical III will consists of

Pedagogy … 40 marks

The candidate shall be instructed to present a full-fledged hypothetical class on a given topic/ area as given by the board of examiners.

5) Viva Voce … 40 marks

a complete viva covering core biochemistry and clinical biochemistry and recent advances

Project Work - No marks only Approved / Not Approved

REFERENCE BOOKS :

1) Tietz. Textbook of Clinical Chemistry – 3rd edition, 1999 printed in India by Harcourt Brace & Company Asia Pvt. Ltd.

2) Tietz. Fundamentals of Clinical Chemistry – 5th edition, 2001 published by Harcourt (India) Private Limited, New Delhi.

3) Michael L. Bishop, Janet L. Duben-Engelkirk, Edward P. Fody Lippincott Williams & Wilkins. Clinical Chemistry – 2000, 4th edition, 1994, ELBS, London.

4) Philip D. Mayne. Clinical Chemistry in Diagnosis & Treatment. 6th edition, 1994, ELBS, London.

5) Alan H. Gowenlock,Janet R. McMurray and Donald M. McLauchlan.Varley's Practical clinical biochemistry . 4th edition 1998, CBS Publishers & Distributors, New Delhi.

6) Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell – Harper's Illustrated Biochemistry – 2003, 26th edition, printed in United States of America by The McGraw-Hill Companies.

7) Harold Varley , Practical Clinical Biochemistry, 4th Edition 1988, CBS Publishers, New Delhi

8) Lawrence A. Kaplan, Amadeo J.Pesce, Clinical Chemistry, 3rd Edition, 1996, Mosby

9) John Baynesand Marek H Dominiczak. Medical Biochemistry, 1999, Harcourt Brace & Company Limited, Printed in Spain.\

10) Lehninger's Principles of Biochemistry, 3rd edition, 2000, published by Macmillan Worth Publishers, U.S.A.

11) Voet & Voet, Biochemistry, 2nd edition 1995, Published by John Wiley & Sons Inc., Singapore.

12) Vasudevan & Sree Kumari's Text book of Biochemistry, 2001, 3rd edition, Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.

13) Thomas M. Devlin – Text book of Biochemistry with clinical correlations – 5th edition, 2002, Published Wiley-Liss, New York, Printed in U.S.A.

14) Lubert Stryer. Biochemistry, 4th edition, 1995, printed in U.S.A. published by W. H. Freeman and Company, NewYork.

15) Rodney Boyer, Modern Experimental Biochemistry, 3rd edition, 2001. published by Addison Wesley Longman (Singapore) Pvt. Ltd., Indian Branch, New Delhi.

16) De Robertis, De Robertis Jr. Cell and Molecular Biology, 8th edition, 2001. Lippincott Williams & Wilkins, U.S.A..

17) Philip D. Mayne. Clinical Chemistry in diagnosis and treatment,1994, 6th edition, Arnold.

18) Garret & Grisham. Biochemistry, 1999, 2nd edition, Saunders college publishing.

19) Bruce Alberts. Molecular Biology of the Cell 2002, 4th edition, published by Garland Science, USA.

20) Cooper, The Cell–A Molecular approach, 2000, 2nd edition, ASM Press, Washington.

21) Benjamin Lewin. Genes VII – 2000, 1st edition, Oxford University Press.

22) Tristram G Parslow, Daniel P Stites, Abba I Terr, John B Imbolen. Medical Immunology, 2003, 10th edition, McGraw Hill.

List of Instruments

Fully automated chemistry analyser -1

Semi- automated analyser -2

Electrolyte Analyser -1

ELISA reader -1

ELISA washer -1

PCR with all essential accessories -1

Tissue Homogeniser -1

Arterial Blood Gas Analyser -1

Fume cupboards 2

Boiling Water baths, with lids having 8-12 Holes 6

Autoclave electric 2

Balance open pan 6

Balance semi micro 2

Balance micro 1

Votex mixers 2

Urinometers 50

Constant temperature water bath 4

Ryles tube 4

Incubator electric with thermostat 4

Hot air oven 4

Magnetic stirrer 2

Pump vaccum 2

Calorimeters 6

Refrigerators 4

Flame Photometer 2

Thermometers 0-2500C 4

Thermometers 0-110 0C 4

Cork borer set 1

Stop watch 4

Spirit lamp 50

Chromatographic chamber 2

Water distillation plant (metallic) 3

All glass distillation apparatus 3

Desicators large size 6

Desicators small size 6

Centrifuge clinical for 12 tubes 6

pH meter- 2

Homogeniser - 2

Microscopes 2

Ultra Violet (U.V.) lamp 1

Bottle dispensers 15

Samplers (autopipettes) different volume range 15

Electrophoresis apparatus with

Power supply for Paper PAGE and AGAROSE 2

Spectrophotometer -1

Binocular research microscopes - 2

Platinum crucible with heating mantle -1

Glass ware as required by standard lab. Like auto micro pipettes, beakers and conical flasks, measuring jars as required.