

**Meenakshi University
Chennai**

Regulations of the University

In exercise of the powers conferred by the Board of Management, Meenakshi University, Chennai, hereby makes the following Regulations:

1. SHORT TITLE

These Regulations shall be called “THE REGULATIONS FOR THE BACHELOR OF MEDICINE AND BACHELOR OF SURGERY (MBBS) DEGREE COURSE OF MEENAKSHI UNIVERSITY.”

2. COMMENCEMENT

They shall come into force from the academic year 2004-05 onwards.

The Regulations and the Syllabus are subject to modification by the Standing Academic Board from time to time

3. TITLE OF THE COURSE

It shall be called Bachelor of Medicine and Bachelor of Surgery (MBBS)

4. ELIGIBILITY FOR ADMISSION

- a) Candidates belonging to all categories except Scheduled Caste / Scheduled Tribe for admission to the Medical Course should have obtained not less than 50% marks in aggregate in Physics, Chemistry and Biology (Botany / Zoology) at the qualifying examination (Academic stream 10 +2 / HSE / PUC) after a period of 12 years study.
- b) Candidates belonging to Scheduled caste / Scheduled Tribe, the minimum marks for admission shall be 40% in lieu of 50% for General Category.
- c) Graduate candidates should have qualified for the B.Sc Degree of an Indian University recognized by the Association of Indian Universities and accepted as equivalent by the Standing Academic Board and Board of Management of this University subject to such conditions as may be prescribed with one of the following subjects as major subject viz. Physics, Chemistry, Botany, Zoology

and another prescribed Science subject of study at least upto the ancillary level; provided that such candidates shall have passed the earlier qualifying examination (Higher secondary examination or an equivalent examination) with the subjects English, Physics, Chemistry, Biology / Botany and Zoology.

- d) Wherever the State Board / Body of appropriate authority has taken into account only the Plus Two level marks to determine the class of the candidate and issue the statement of marks accordingly, it alone would be taken into consideration.
- e) Wherever the State Board / Body or appropriate authority has taken into account the marks obtained at the Plus One and Plus Two level to determine the class of the candidate and furnish the statement of marks, accordingly, the aggregate of the two examinations shall be taken into consideration.
- f) Candidates who have studied abroad, the equivalent qualification as determined by the Association of Indian Universities shall form the guidelines to determine the eligibility and should have passed in the subjects of Physics, Chemistry, Biology (Botany / Zoology) and English upto the 12th Standard level with 50% marks aggregate.
- g) Any criteria not covered under the above provisions, the ruling of the Eligibility committee shall be adopted.
- h) Candidates who have passed the Senior Secondary School examination of National Open School with minimum 5 subjects with any of the following groups of subjects:
 - a) English, Physics, Chemistry, Botany, Zoology
 - b) English, Physics, Chemistry, Biology and any other language
(To be read along with “Qualification for Admission” ‘a’ and ‘b’)
- i) Improvement of marks in the Higher Secondary Examinations. Candidates belonging to all categories who have passed the qualifying examination without acquiring the stipulated minimum academic requirements prescribed in the first appearance are permitted two opportunities for improvement within one year of the first appearance in the qualifying examination for determining the eligibility for admission to the first year MBBS Course.
- j) Reappearance of failed candidates: belonging to all categories, who have failed in the qualifying examination in the first appearance are permitted two opportunities within a period of one year following the first appearance in the qualifying examination, for passing of failed subjects to determine the eligibility for admission to the first year MBBS course.

5. CRITERIA FOR SELECTION

Students for MBBS Degree Course shall be admitted based on performance at the Competitive Examinations held by this University.

6. AGE LIMIT FOR ADMISSION

Candidate should have completed the age of 17 years at the time of admission or would complete the age of 17 years on or before 31st December of the year of admission to the first year MBBS Course.

7. ELIGIBILITY CERTIFICATE

No candidate shall be admitted to the MBBS Course unless the candidate has obtained and produced Eligibility Certificate issued by this University. The candidate has to make an application to the University with the Original and Xerox copies of the following documents along with the prescribed fee: 1) Higher Secondary or equivalent Examination Mark Sheet and 2) Transfer Certificate

Candidate should obtain Eligibility Certificate before the last date for admission as notified by the University.

8. REGISTRATION

A candidate admitted to the MBBS Course of this University shall register by remitting the prescribed fees along with the application form for registration duly filled in and forwarded to this University through the Head of the Institution within the stipulated date.

9. DURATION OF THE COURSE

The period of certified study for the Course of Bachelor of Medicine and Bachelor of Surgery shall be of 4½ academic years and one year of Compulsory Rotatory Internship.

10. COMMENCEMENT OF THE COURSE

The course shall commence from 1st August of an academic year.

11. ACADEMIC TERMS

(1) The period of 4 ½ years is divided into three phases as follows:

(a) Phase – I (I MBBS) (One year) consisting of Pre-clinical subjects (Human Anatomy, Physiology including Bio-Physics, Bio-chemistry and introduction to Community Medicine including Humanities). Besides 60 hours for introduction to Community Medicine including Humanities, rest of the time shall be somewhat equally divided between Anatomy and Physiology plus Bio-chemistry combined (Physiology 2/3 and Bio-chemistry 1/3).

(b) Phase – II (II MBBS) (1 ½ years) consisting of para clinical / clinical subjects.

During this phase teaching of para-clinical and clinical subjects shall be done concurrently.

The para-clinical subjects shall consist of Pathology, Pharmacology, Microbiology, Forensic Medicine including Toxicology and part of Community Medicine

The clinical subjects shall consist of all those detailed below in Phase III.

Out of the time for para-clinical teaching approximately equal time shall be allotted to Pathology, Pharmacology, Microbiology and Forensic Medicine and Community Medicine combined (1/3 Forensic Medicine and 2/3 Community Medicine)

(c) Phase – III (III MBBS) (Two years)– Continuation of study of clinical subjects from phase II

The clinical subjects to be taught during Phase II and III are Medicine and its allied specialities, Surgery and its allied specialities, Obstetrics and Gynaecology and Community Medicine.

Besides clinical posting the rest of the teaching hours shall be divided between didactic lectures, demonstrations, seminars, group discussion etc. in various subjects.

The training in Medicine and its allied specialities will include General Medicine, Paediatrics, Tuberculosis and Chest, Skin and Sexually Transmitted Diseases, Psychiatry, Radio-diagnosis, Infectious diseases etc. The training in Surgery and its allied specialities will include General Surgery, Orthopaedic

Surgery including Physiotherapy and Rehabilitation, Ophthalmology, Oto-Rhino-Laryngology, Anaesthesia, Dentistry, Radio-therapy etc. The Obstetrics & Gynaecology training will include family medicine, family welfare planning etc.

- (2) The first year (approximately 240 teaching days) shall be occupied in the Phase I (Pre-clinical) subjects.

No student shall be permitted to join the Phase II (Para-clinical / clinical) group of subjects until he / she has passed in all the Phase I (Pre-clinical) subjects for which he will be permitted not more than four chances (actual examination), provided the four chances are completed within three years from the date of enrolment.

After passing pre-clinical subjects, 1½ years shall be devoted to para-clinical subjects. Phase II will be devoted to para-clinical and clinical subjects, along with clinical postings. During clinical phase (Phase III) pre-clinical and para-clinical teaching shall be integrated into the teaching of clinical subjects wherever relevant.

12. CUT OFF DATES FOR ADMISSION TO EXAMINATIONS

The candidates admitted from 1st August to 30th September of the academic year will be registered to take up their First year examination on 1st August of the next year.

There will not be any admission after 30th September for the academic year.

13. WORKING DAYS IN AN ACADEMIC YEAR

Each academic year shall consist of not less than 240 working days.

14 ATTENDANCE REQUIRED FOR ADMISSION TO EXAMINATION

- a) No candidate shall be permitted to any one of the parts of MBBS examination unless he / she has attended the Course in the subject for the prescribed period and produces the necessary certificates of study and attendance from the Head of the Institution.

- b) A candidate is required to put in minimum of 80% of attendance in both theory and practical / clinical separately in each subject before admission to the examination.
- c) A candidate, who has not completed the course in any subject and not submitted the course completion certificate from the Head of the Department, will not be permitted to appear for that particular subject alone. If the candidate has got adequate attendance in other subjects he / she will be permitted to appear for examination in those subjects.
- d) 80% attendance for the additional period is compulsory.
- e) Attendance earned by the student should be displayed on the Notice Board of the department monthly and a copy of the same sent to the University for computerization and parents shall be informed regarding the shortage of attendance of their wards through e-mail (if available) or by post by the Institution.

15. SUBMISSION OF LABORATORY RECORD NOTE BOOK

At the time of practical / clinical examination each candidate shall submit to the Examiners his / her laboratory note book duly certified by the Head of the Department as a bonafide record of the work done by the candidate.

The practical record shall be evaluated by the concerned Head of the Department (Internal Evaluation) and the practical record marks shall be submitted to the University 15 days prior to the commencement of the theory examinations.

The candidate may be permitted by the examiners to refer to the practical record book during the practical examination in the subject of Bio-chemistry only. No other materials, handwritten, cyclostyled or printed guides are allowed for reference during the practical examinations.

In respect of failed candidates the marks awarded for records at previous examination will be carried over to the next examinations. If a candidate desires he / she may be permitted to improve his / her performance by submission of fresh records.

16. CONDONATION OF LACK OF ATTENDANCE

Condonation of shortage of attendance upto a maximum of 10% in the prescribed eligible attendance for admission to an examination rests with the discretionary power of the Vice-Chancellor. A candidate lacking in attendance shall submit an application

in the prescribed form and remit the stipulated fee 15 days prior to the commencement of the theory examination. The Head of the Department and Head of the Institution should satisfy themselves on the reasonableness of the candidates request while forwarding the application with their endorsements to the Controller of Examination who would obtain the Vice-Chancellor's approval for admission to the examinations. No application would be reviewed if it is not forwarded through proper channel.

Condonation for lack of attendance shall be taken up for consideration under the following circumstances:

- a) Any illness afflicting the candidate. (The candidate should submit to the Head of the Institution a Medical Certificate from a registered Medical Practitioner soon after he / she returns to the Institution after treatment.)
- b) Any unforeseen tragedy in the family. (The parent / guardian should give in writing the reason for the ward's absence to the Head of the Institution.)
- c) Any other leave the Head of the Institution deems reasonable for condonation.
- d) 50% of marks in Internal Assessment is compulsory for condonation of lack of attendance.

17. COMMENCEMENT OF EXAMINATION

August 1st / February 1st. If the date of commencement falls on Saturdays, Sundays or declared public holidays, the examination shall begin on the next working day.

18. REVALUATION OF ANSWER SCRIPTS

There shall be no revaluation of answer papers of failed candidates in any under graduate examination. However, re-totaling of failed subjects will be entertained on payment of the prescribed fee.

19. INTERNAL ASSESSMENT

- a) A minimum of four written examinations shall be conducted in each subject during an academic year and the average marks of three best performances shall be taken into consideration for the award of Internal Assessment marks.
- b) A candidate should obtain a minimum of 35% of marks in Internal Assessment to permit to appear for University Exam.

- c) A minimum of three practical examinations shall be conducted in each subject during an academic year and an average of two best performances shall be taken into consideration for award of Internal Assessment marks.
- d) A failed candidate in any subject should be provided an opportunity to improve his Internal Assessment marks by conducting a minimum of two examinations in theory and practical separately and the average may be considered for improvement. If failed candidates do not appear for an improvement in the failed subject (s) the internal marks awarded for the previous examination shall be carried over for subsequent appearance (s).
- e) The internal assessment marks (both in written and practicals taken together) should be submitted to the University endorsed by the Head of the Institutions 15 days prior to the commencement of the theory examinations.

20. RE-ADMISSION AFTER BREAK OF STUDY

- a) The calculation of the break of study of the candidate for readmission shall be calculated from the date of first discontinuance of the Course instead of from the date of admission.
- b) Candidates having break of study shall be considered for readmission provided, they are not subjected to any disciplinary action and no charges are pending or contemplated against them.
- c) All readmissions of candidates are subject to the approval of the Vice-Chancellor.
- d) A candidate having a break of study of less than 6 months shall apply for readmission for condonation to the Academic Officer of this University. The candidate may be readmitted in the corresponding course of study. The candidate has to fulfill the attendance requirements of the University and shall be granted exemption in the subjects he has already passed.
- e) A candidate having a break of study of more than 6 months but less than 2 years shall apply for readmission for condonation to the Academic Officer of this University. The candidate may be readmitted to the beginning of the academic year of the course. The candidate has to fulfill the attendance requirements of the University and shall be granted exemption in the subjects he has already passed.

- f) A candidate having a break of study of more than 2 years and upto 5 years shall apply for the readmission for condonation to the Academic Officer of this University. The candidates may be readmitted in the corresponding course of study. The candidate has to fulfill the attendance requirements of the University and shall not be granted exemption in the subjects he has already passed.
- g) Candidates having a break of study of 5 years and above from the date of discontinuance and more than two spells of break will not be considered for readmission.

21. MIGRATION / TRANSFER OF CANDIDATES

- a) Migration / Transfer of candidates from one recognized Medical College to another recognized Medical College of this University or from another University shall be granted as per the recommendations of the Medical Council of India regulations.
 - (i) Migration may be considered in exceptional causes* or extreme compassionate ground.
 - * Death of a supporting guardian, illness of the candidate causing disability, Disturbed conditions as declared by Govt. in the Medical College area.
- b) The combination of attendance shall be granted to a transferee for admission to the examinations of this University on payment of the necessary fee and satisfying the Medical Council of India regulations.
- c) The applicant candidate should have passed first MBBS Exam
- d) Migration during clinical course of study and Internship shall not be allowed on any ground.
- e) Both the college i.e. one at which the student is studying at present and one to which migration is sought should be recognized by the Medical Council of India
- f) All migrations / transfers are allowed on payment of the prescribed fee.
- g) All migrations / transfers are subject to the approval of the Vice-Chancellor

22. MARKS QUALIFYING FOR A PASS

A candidate shall be declared to have passed the examination if he / she obtains 50% of the marks in University Theory examination, 50% of the marks in University Practical examination and 50% aggregate in University Theory, Practical, Oral and Internal Assessment taken together.

23. CLASSIFICATION OF SUCCESSFUL CANDIDATES

- a) A successful candidate who secures 75% and above of the marks in his / her first appearance in all the subjects within the prescribed period will be declared to have passed in first class with Distinction.
- b) A successful candidate who secures 75% and above of the marks in his / her first appearance in a subject within the prescribed period will be declared to have passed in first class with Distinction in that particular subject.
- c) A successful candidate who secures 60% and above of the marks in his / her first appearance in all the subjects within the prescribed period will be declared to have passed in the First Class.
- d) All other successful candidates' shall be declared to have passed in Second class.

24. CARRY OVER OF FAILED SUBJECTS

- a) Passing in First MBBS Professional examination is compulsory before proceeding to Phase II training.
- b) A student who fails in the II MBBS professional examination shall be permitted to carry the one failed subject to Phase III of the MBBS course but shall not be allowed to appear in III MBBS Professional Part I examination unless he / she passes all the subjects of the II MBBS Professional examination. Passing in II MBBS Professional examination is compulsory before entering Part II of Phase III (Final year) of the course.
- c) Passing in III MBBS Professional (Part I) examination is not compulsory before entering for Part II training; however passing of III MBBS Professional (Part I) is compulsory for being eligible to appear for III MBBS Professional (Part II) examination.

25. SUBJECTS OF STUDY

MBBS – I Year

- 1) Anatomy
- 2) Human Physiology including Bio-Physics
- 3) Biochemistry

26. PATTERN OF EXAMINATION

The Theory Examination will consist of two sections, viz. Theory and MCQ

DISTRIBUTION OF MARKS

S. No	Subject	Theory	Viva	Practical	IA	Total
1.	Anatomy I & II	50 Marks each	20	40	40	200 Marks
2.	Physiology including Biophysics I & II	50 marks each	20	40	40	200 Marks
3.	Biochemistry I & II	50 marks each	20	40	40	200 Marks

15 MCQ	15 Marks	15 Marks
2 Essays	10 Marks each	20 Marks
5 Short Notes	2 Marks each	10 Marks
5 Ultra Short Notes	1 Mark each	5 Marks
Total		50 Marks

Theory Total (50 marks x 2 Papers)	100 Marks
Practicals	40 Marks
Internal Assessment	40 Marks
Viva - Voce	20 Marks
Grand Total	200 Marks

Minimum for Passing

50% marks in the University written examination	50/100
50% marks in the University practical examination	20/40
50% marks in the aggregate of written, oral, practical and internal assessment	100/200

26. SCHEME OF EXAMINATION

S. No.	Subject	Marks
1	Anatomy – I	50
2	Anatomy – II	50
3	Human Physiology including Biophysics – I	50
4	Human Physiology including Biophysics – II	50
5	Biochemistry – I	50
6	Biochemistry – II	50

16. SYLLABUS

ANATOMY

A. OBJECTIVE

At the end of the first year, the student should be able to:

- Comprehend the normal disposition, inter-relationships, functional and applied anatomy of the various structures in the body.
- Identify the microscopic structure of various organs and tissues and correlate the structure with the functions as a pre requisite for understanding the altered state in various disease processes.
- Comprehend the basic structure and connections of the central nervous system to analyze the integrative functions of organs and systems. The student should be able to locate the site of gross lesions according to the neurological deficits encountered.
- Should know the basic principles of embryology and the sequential stages in the development of organs and organ systems, including variations and abnormalities, effects of teratogens and genetic modes of inheritance.

B. COURSE CONTENTS

- Paper – I
- General Anatomy
 - General Histology & Systemic Histology of Abdominal and Pelvic organs
 - General Embryology & Systemic Embryology of Abdomen, Pelvis and Limbs
 - Gross Anatomy of Upper Limb, Lower Limb, Abdomen and pelvis
 - Medical Genetics

- Radiological anatomy
- Cross sectional anatomy of abdomen and pelvis
- Surface Anatomy of Limbs, Abdomen and Pelvis

Paper – II • General Anatomy

- Embryology
- Histology
- Gross anatomy of Head & Neck, Thorax, Brain and Spinal Cord
- Radiological anatomy
- Cross sectional anatomy of Thorax
- Surface Anatomy of Thorax, Head and Neck and Brain and Spinal Cord.

C. THEORY

Paper - I

1. General Anatomy

Osteology: • Classification of bones with examples • General features of bones
 • Types of ossification and normal development • Names of bones of body and their position • Blood supply to bones • Ossification of limb bones for age determination • Microscopic anatomy of bones

Muscular System: • Classification of muscles with examples • Identification of muscles of the body • Attachments, nerve supply and action of muscles
 • Microscopic anatomy of muscles.

Arthrology: • Classification of joints with examples • General features of different types of joints • Detailed study of major joints of limbs and movements

Lymphatic System: • Gross anatomy of major groups of Lymph nodes in the body and their drainage areas • Thoracic duct and its tributaries

Organs of Digestive System: • Position, parts, relations, blood supply, nerve supply, normal development, major anomalies, microscopic anatomy, sphincters of gastrointestinal system

Organs of Genitourinary System: • Position, relations, blood supply, nerve supply, normal development, major anomalies, microscopic structure

2. General Histology

Micro Anatomy: • General Histology – Study of basic tissues of body
• Functional correlation of the structural components of the organs • Systemic Histology – Structure of the organs of abdomen and pelvis

3. General Embryology

• General Embryology

- a) Definition of embryology, gestation period and its subdivisions
 - Definition and structure of gonads – Testis & Ovary • Gametogenesis – Structure of sperm and Ovum, Spermatogenesis and Oogenesis
 - Growth of ovarian follicle, ovarian and uterine cycles
- b) First Week of development – Definition and process of fertilization, formation of zygote, cleavage and division, formation of morula and blastocyst, formation of deciduas and its subdivisions, pre implantation changes in the endometrium, implantation, types and abnormal sites of implantation
- c) Second Week of development -
 - Differentiation of embryoblast and trophoblast • Changes in the embryoblast; Bilaminar germ disc
 - Changes in the trophoblast – formation of cytotrophoblast and syncytiotrophoblast • Amniotic membrane, yolk sac, extra embryonic mesoderm, extra embryonic coelom and connecting stalk • Formation of chorion, amniotic cavity, primary yolk sac cavity • Appearance of prochordal plate
- d) Third Week of development -
 - Appearance of primitive streak and primitive node • Formation of infra embryonic mesoderm resulting in Trilaminar germ disc • Formation of Notochord • Formation of buccopharyngeal and cloacal membranes • Formation of pericardial bar
 - Formation of paraxial, intermediate and lateral plate mesoderm
 - Formation of secondary yolk sac • Formation of Intra embryonic coelom and allantoic diverticulum • Derivatives of ectoderm, mesoderm and endoderm
- e) Fourth Week of development -
 - Formation of somites • Formation of neural tube • Cephalocaudal and lateral foldings • Formation of a cylindrical body • Stomatodeum, proctodeum, vitello intestinal duct
 - Gut and its subdivisions – fore gut, midgut and hindgut.

- f) Placenta - • Formation and features of placenta • Functions of placenta
 - Types and abnormalities of placenta • Placental circulation
 - Formation and features of umbilical cord.
- g) Formation of Amniotic cavity, amniotic fluid, foetal membranes, Twins, congenital malformations
- h) Post Natal Growth and Development: • Meaning of the terms growth and development • Types of postnatal growth and development and factors influencing them • Milestones of development, adolescent growth spurts • Assessment of growth and development

- Systemic Embryology

- a) Normal development of each system
- b) Development of individual organs of : • Digestive system • Urinary and genital system • Associated anomalies

4. Gross Anatomy of Upper Limb, Lower Limb, Abdomen and pelvis

5. Medical Genetics

Human Genetics: • Nucleus, DNA, Chromosomes, classification, karyotyping, chromosomal aberrations (Klinefelter's and Turner's syndrome) and their prenatal diagnosis, Genetic markers

6. Radiological anatomy

- Identification of normal anatomical features in skiagrams, including special radiological investigations (Barium meal series, IVP, Hystero Salpingography)
- Reading of CT scan, Ultrasound pictures

7. Cross sectional anatomy of abdomen and pelvis

- Cross sections of abdomen, pelvis to understand and interpret the inter relations of organs

8. Surface Anatomy of Limbs, Abdomen and Pelvis

- Surface features of the body and projection of the outline of liver, kidneys, important blood vessels and nerves

Paper – II

1. General Anatomy

- a) Cardio – Vascular System: • Position and parts of the heart • Names of blood vessels and their distribution • Normal development of heart and major blood vessels • Common developmental anomalies of heart (atrial and ventricular septal defects, Fallot's Tetralogy, transposition of great vessels)
- b) Organs of Respiratory System: • Position, parts, relations, blood supply, microscopic anatomy and normal development
- c) Endocrine System and Individual Endocrine Glands: • Location, relations, blood supply, nerve supply, microscopic anatomy, normal development, secretions and main functions.
- d) Nervous System and its Components: • Meninges, neuron, neuroglia, myelination, parts of nervous system and their functions • Blood supply • Ventricles • Motor and sensory pathways • Functional areas • Cranial nerves • Microscopic anatomy of cerebrum, cerebellum midbrain, pons and medulla • Normal development and common developmental anomalies like spina bifida, hydrocephalus
- e) Special Sensory Organs: Gross anatomy and microanatomy of • Eyeball • Ear • Nose • Skin • Tongue

2. Embryology

Development of individual organs of : • Head and Neck • Nervous System • Special sense organs • Endocrine glands • Development of face • Pharyngeal arches, Derivatives of pharyngeal arches and pouches • Associated anomalies

3. Histology
 - Micro Anatomy: • Functional correlation and the structural components of the organs of Head and Neck, Thorax and various parts of Brain and Spinal Cord
4. Gross anatomy of Head & Neck, Thorax, Brain and Spinal Cord
5. Radiological anatomy
 - Identification of normal anatomical features in skiagrams, including special radiological investigations
 - Reading of CT scan, Ultrasound pictures
6. Cross sectional anatomy of Thoracic organs
7. Surface Anatomy
 - Heart, Lungs, Pleura, Glands and Blood vessels in Head and Neck and Major fissures in Brain and Spinal Cord.

D. PRACTICALS

Gross Anatomy

1. Upper Limb
 - Dissection: Pectoral and Scapular regions, axilla, shoulder region, arm and forearm
 - Prosected parts: Joints, Palm and dorsum of Hand
2. Lower Limb:
 - Dissection: Front of thigh, Gluteal Region, Back of Thigh, Popliteal fossa, front & back of leg
 - Prosected parts: Joints and foot
3. Thorax:
 - Dissection: Chest wall, mediastinum, lungs and heart
4. Abdomen:
 - Dissection: Anterior abdominal wall, inguinal region, visceral organs, posterior abdominal wall
5. Pelvis:
 - Dissection: Pelvis viscera and blood vessels
 - Prosected parts: Perineum, ischiorectal fossa

6. Head and Neck:
 Dissection: Superficial and deep dissections of head and neck, orbit, submandibular region
 Prosected parts: Temporal and infratemporal fossa, cranial cavity, Nasal cavity, Pharynx, larynx, Eyeball and ear

7. Nervous System: Surface of brain, blood vessels and sections of brain at various levels.

- Demonstration • Bones • Brain and Spinal cord • Cross-sectional anatomy • Radiological anatomy • CT and MRI scan
- Microscopic Anatomy • Stained slides of all the tissues and organs
- Developmental Anatomy • Models to demonstrate various stages of early foetus and different organs
- Genetics • Demonstration of normal karyotype and common abnormal conditions

E. SCHEME FOR CONDUCTING PRACTICAL AND VIVA EXAMINATION

- Practicals – 10 spotters each carrying 2 marks, 2 discussions each carrying 10 marks, distributed evenly as per Paper I and Paper II portions
- Spotters – Upper limb, Lower limb, Abdomen, Pelvis, Head and Neck, Thorax, Brain and Spinal cord, 2 specimens for discussion (one each from portions of I and II)
- Histology – 10 spotters each carrying 2 marks, 2 discussions each carrying 10 marks – 1 General and 1 Systemic
- Viva 10 marks each – Osteology, Embryology, Radiology, Surface anatomy

F. AREAS FOR INTEGRATED TEACHING

- Antenatal growth and development - Obstetrics and Gynaecology
- Postnatal growth and development - Paediatrics and community medicine
- Anatomical basis of birth control measures - Obstetrics and Gynaecology
- CT Scan, Ultra sound, MRI Scan - Radiology
- Joints, movements and applied aspects - Orthopaedics

- Abdominal incisions, hernias - Surgery
- Neuro – Anatomy - Physiology and medicine
- Embryological basis of important and common congenital anomalies - Paediatrics, Obstetrics & Gynaecology

G. RECOMMENDED BOOKS

1. Dissection manual – Cunningham’s manual of practical Anatomy – by G.J. Romanes – Vol. I, II and III.
2. Gross Anatomy – Clinical oriented Anatomy – by Keith L. Moore
3. Gross Anatomy – Grant’s method of Anatomy
4. Histology – Text book of Histology – Inderbir Singh
5. Histology – Atlas of Human Histology – DI Fiore
6. Embryology – Langman’s Medical Embryology – Sadler
7. Embryology – Text book of Embryology – Inderbir Singh
8. Neuro Anatomy – Clinical Neuro Anatomy – Recharad Snall
9. Neuro Anatomy – Text book of Neuro Anatomy – Inderbir Singh
10. Medical Genetics – Dr. V. Kapur & Dr. R.K. Suri
11. Reference – Gray’s Anatomy
12. Reference – Regional and applied anatomy – R.J. Last
13. Reference – A synopsis of surgical anatomy – Lee McGregor

HUMAN PHYSIOLOGY INCLUDING BIO-PHYSICS

A. GOAL

The broad goal of the teaching of undergraduate students in physiology aims at providing the students comprehensive knowledge of the normal functions of the organ system of the body to facilitate an understanding of the physiological basis of health and disease.

The broad goal of teaching Biophysics to undergraduate students is that they should understand basic physical principles involved in the functioning of body organ in normal and diseased conditions

B. OBJECTIVES

At the end of training in physiology the student should be able to:

- Describe normal functions, their Physico – chemical principles and regulatory mechanisms of various organs and systems of the body
- Apply these principles in understanding normal body functions
- Assess the relative contribution of each organ system to the maintenance of the milieu interior
- Elucidate the physiological aspects of normal growth and development
- Analyze the physiological responses under different environmental stresses such as heat, low and high atmospheric pressure and industrial pollutants
- Correlate knowledge of physiology of human reproductive system in relation to National Family Welfare Program
- List of physiological principles underlying pathogenesis and treatment of disease
- Develop intellectual skills in self – learning and problem solving and continue to learn the advances in the subject and to apply the same in medical practice as and when warranted
- Correlate physiological functions with disease processes and apply these principles for diagnosis and management of disease
- To know the functioning of individual organ(s) and system(s) in relation to the body as a whole to develop holistic concept / approach
- Conduct experiments designed for the study of physiological phenomena

- Distinguish between normal and abnormal data derived as a result of tests, which he / she has performed and observed in the laboratory
- Integrate and co-ordinate knowledge in other disciplines with that of physiology
- Demonstrate the habit of making careful and exact observations and develop skills for performing purposeful experiments for elucidation of various physiological phenomena
- At the end of integrated teaching the student shall acquire an integrated knowledge of organ structure, function and its regulatory mechanisms. Students should develop proper attitudes, scientific temper and moral values in understanding the importance of physiology and medicine as whole.

C. COURSE CONTENT

Paper – I • General Physiology • Muscle and Tissue • Blood • Digestion
 • Excretion and body fluids • Endocrinology • Reproduction

Paper – II • Respiration • CVS • Special senses • CNS

D. THEORY

1. General Physiology

- Cell function – Morphology of cell components and functions
- Body fluids – Compartments and their measurements, fluid and electrolyte balance
- Concept of homeostasis, milieu interior, physiological norms –their range and control
- Structure and functions of cell membrane mechanism and modes of transport across cell membrane - Intercellular communication – Membrane receptors, second messengers and signal transduction.

2. Tissues

- Epithelial – properties, types, specializations functions – modes of secretion – classification of glands
- Connective tissue – classification – Types of cells and fibres – Brown and white adipose tissue – functions. Supporting tissue cartilage, bone types and properties.

3. Nerve Muscle Physiology

- Structure of neuron forces, affecting movement of ions across the cell membrane - Genesis of resting membrane potential, conduction of nerve impulse - Classification of nerve fibres, nerve block - Degeneration and regeneration of nerve fibres - Structure of neuromuscular junction - Neuromuscular transmission - Drugs affecting neuromuscular transmission - Neuromuscular junction disorders - Effects of denervation.
- Structure of skeletal muscle - Events in skeletal muscle contraction and relaxation - Types of skeletal muscle fibre - Motor units – EMG - Gradation of skeletal muscle force (Summation and recruitment) oxygen dept. length tension relationship structure of smooth muscle – Types of smooth muscle – Electrical activities of smooth muscle – Neural and chemical control of smooth muscles – Structure of cardiac muscle – Electrical potentials of cardiac muscle – Length tension relationship of cardiac muscle
- Recording procedure of membrane potentials – Voltage clamp technique – Thermal changes during muscle contraction

4. Blood

- Composition and function, volume and measurement of blood and plasma – Functions of plasma proteins – Oncotic pressure
- RBC – Morphology, function, Erythropoiesis and its regulation – Classification of anemia's and principles of management of iron deficiency, B₁₂ and Folic acid deficiency anemias – Erythrocyte sedimentation Rate and factors determining it – Hemoglobin, Jaundice
- WBC – Classification and functions of leukocytes – Types and mechanism of immunity – Immunodeficiency disorders, complement system
- Structure and functions of platelets and their role in coagulation heamostasis and its disorders – Role of vascular endothelium in blood coagulation – Anti clotting mechanism – Anticoagulants and their mechanism of action
- Blood Groups – ABO, Rh, X, MN system etc. - Blood transfusion and reactions due to incompatible blood transfusion
- Formation, composition and functions of lymph – Reticulo endothelial system

5. Digestive System

- Functional anatomy of the Gastro Intestinal tract (GIT) – Structure and innervation of GIT – Gastro Intestinal Hormones

- Mastication, Salivary Digestion – Deglutition, lower oesophageal sphincter, achalasia gastric motility, gastric emptying vomiting, motility of small intestine peristalsis and segmentation, colonic motility, defecation
- Gastro intestinal secretions, their function in digestion, composition, formation, production, control / regulation and factors affecting their secretion salivary secretion, gastric secretion including control of acid secretion and pepsinogen secretion – Exocrine pancreatic secretion, structure and functions of liver and gall bladder bile secretion, intestinal secretions viz. duodenal, small intestine and colon
- Peptic ulcer, Intrinsic factor and pernicious anaemia, jaundice, gall stones, mal absorption syndrome and adynamic ileus. Intestinal bacteria, blind loop syndrome, constipation, diarrhea, megacolon
- Digestion and absorption of carbohydrates, proteins, lipids, vitamins and minerals

6. Excretion

- Functional anatomy of Excretory system – structure of Nephron
- Renal circulation – Renal Blood flow and its measurement – Renal function tests – Principles of dialysis
- Glomerular filtration – Reabsorption of essential nutrients sodium, potassium, calcium phosphate, bicarbonate and water counter current mechanism
- Secretion of substances like Hydrogen, potassium and ammonia – Excretion of metabolites – Acidification of urine
- Concept of plasma clearance and concentration of urine
- Mechanism of diuresis, action of diuretics
- Juxtaglomerular apparatus – Role of kidney in electrolyte, water and acid base balance
- Structure of urinary bladder and its nerve supply, cysto metrogram, physiology of micturition – Atonic, autonomic and automatic bladder
- Structure and functions of skin

7. Endocrine Glands

- General principles of regulation of endocrine glands – Receptors – Second messengers
- Pituitary gland: Physiological anatomy of pituitary gland – Anterior pituitary hormones – physiology of growth clinical correlates TSH, ACTH,

LH, FSH, PL Hormones and functions > Intermediate Lobe – Pro-opiomelanocortin – products > Posterior pituitary Hormones: Biosynthesis transport and metabolism of hormones hormone receptor and blockers – Physiological actions and Regulations – Clinical correlation – Hypo and Hypersecretion

- Hypothalamus: Hormones – Functional anatomy inter relationship between hypothalamus, anterior and posterior pituitary and target organs – Clinical correlation – hypo and hyper secretion
- Thyroid Gland: Physiological anatomy formation, secretion, Transport and metabolism of T₃ and T₄ – effects of Thyroid hormone and regulation – of its secretion – Hypo and Hyper secretion – Clinical correlation – Calcitonin
- Para thyroid glands: Ca⁺ Phosphorus metabolism – Bone physiology – Vitamin D and Calcitriol – Physiological Anatomy, secretions, transport and functions of Parathormone – Effect of other hormones and hormonal agents on calcium homeostasis hypo and hyper secretion – Clinical correlation
- Pancreas: Introduction – Islet structure – Biosynthesis and secretion of insulin – Fate, effects, mechanism of action of insulin – regulation of insulin secretion – Clinical correlation, Hypo and Hyper secretion – Diabetes mellitus – Glucagon and other islet cell hormones and their effects
- Adrenal Glands: Introduction > Adrenal Medulla: Morphology – Biosynthesis functions and regulation of adrenal medullary hormones – pheochromocytoma > Adrenal cortex: Structure – Biosynthesis of adrenal cortical hormones – transport, metabolism and excretion of adrenal cortical hormones > Effects of adrenal androgens and oestrogens > Glucocorticoids – Physiological effect – Regulation of secretion > Mineralocorticoids – Regulation of aldosterone secretion – role played by it in the regulation of salt balance > Adrenocortical hypo & hyper functions in humans
- Minor Endocrine glands: Kidney, pineal body, thymus, atrium of heart
- Local Hormones – Bradykinin, substance P prostaglandin, Histamin, serotonin, etc.

8. Reproduction

- Introduction, sex determination and chromosomal sex in brief, factors influencing differentiation of genitalia
- Male gonads and genitalia, structure, gametogenesis, erection, emission and ejaculation, semen composition, endocrine functions of testis,

biosynthesis secretion and actions of testis hormones, control of testicular function, abnormalities

- Female gonads and genitalia, ovarian function, menstrual cycle, hypothalamus, pituitary, uterus, ovary, vaginal cyclic changes, biosynthesis, secretion and actions of estrogen and progesterone
- Fertilization and conception, contraception, corpus luteum of pregnancy, chorion and placental – hormones, pregnancy tests, physiology of pregnancy, labour, lactation

9. Respiration

- Introduction – functional anatomy of respiratory system, surfactant, compliancy pulmonary pressure
- Mechanism of respiration – diffusion and transport of gases, O₂ dissociation
- Regulation of respiration, neural and chemical
- Pulmonary circulation
- Respiratory adjustments in health and diseases – Hypoxia – types, oxygen therapy, periodic breathing, Asphyxia, Dysbarism, Cyanosis, effect of exercise, high altitude physiology, mountain sickness, space physiology
- Artificial respiration
- Lung volume capacity and its significance

10. Cardiovascular System

- Structure and properties of cardiac muscle, action potential
- Origin and spread of cardiac impulses, sinus arrhythmia
- ECG – 12 leads, tracing in lead II, correlation with action potential and cardiac cycle
- Cardiac cycle – mechanical events, JVP and radial arterial pulse tracing
- Cardiac output – measurement, factors affecting
- Hemodynamics – pressure at different segments of vasculature and laws governing it
- Arterial blood pressure – systolic pressure, diastolic pressure, pulse pressure, mean arterial pressure, normal values, methods for evaluating blood pressure, factors for maintenance and regulation, hypertension, nervous and humoral regulation of blood pressure

- Starling forces – formation and reabsorption of tissue fluid, pathophysiology of shock
- Regional circulation – pulmonary, cerebral, coronary, splanchnic, cutaneous and foetal circulations
- Cardiovascular changes during exercise

11. Special Senses

- Vision – functional anatomy, aqueous humour, glaucoma, image formation mechanism, refractory error, layers of retina, photoreceptors, photochemistry of vision, light and dark adaptation, electrical responses, electroretinogram, visual pathway, lesions, color vision, movements
- Hearing – functional anatomy, middle ear function, cochlea, auditory pathway, hearing defects, tests for hearing, audiogram
- Smell – receptor organ and pathway, physiology of olfaction, abnormalities
- Taste – receptor organ and pathway, physiology of taste, abnormalities

12. Central Nervous System

- General Neuro Physiology: > Neuron – structure, types, neuroglia, nerve degeneration, regeneration, denervation hypersensitivity > Sensory receptors – classification and function, electrical and ionic events in receptors, receptor potential > Synapse and junctional transmission – properties, neurotransmitters, synaptic plasticity and learning > Reflexes – introduction, mono and polysynaptic reflexes, properties > Spinal cord – group of cells, transverse section, anterior nerve root, posterior nerve root, ascending tracts > Pain – types, pathways, pain inhibiting pathways > Descending tracts – Pyramidal and extra pyramidal tracts, complete section and hemi section of spinal cord
- Special Neurophysiology: > Cerebral cortex – layers, lobes, methods of study, function of each lobe > Thalamus – thalamic nuclei, connections, functions, thalamic syndrome > Basal ganglia – Nuclei, connections, circuits, functions, lesions of basal ganglia – clinical correlations > Hypothalamus – nuclei, connections, functions, lesions – experimental and clinical syndromes > Reticular formation – Ascending and descending pathways, ARAS and EEG > Sleep – theories, physiological changes during sleep, REM and NREM sleep, disorders of sleep > Cerebellum – lobes, cortex, circuit, deep nuclei, connections, functions, cerebellar syndrome, cerebellar function tests > Vestibular apparatus – Semicircular canal, otolith organs, mechanism of equilibrium > Maintenance of posture, tone, equilibrium, muscle spindle types > Autonomic nervous system –

organization, division with examples of autonomic reflexes, chemical transmission > Limbic system – parts, circuits, functions > Higher functions – maintenance of speech – mechanism of learning – mechanism of memory, types – conditioned reflexes > CSF – formation, circulation, absorption, function, lumbar puncture

E. PRACTICAL

Major experiments – • Erythrocyte count • Leucocyte count • Leucocyte differential count • Eosinophil count • Clinical examination of cardiovascular system • Clinical examination of respiratory system • Clinical examination of sensory nervous system • Clinical examination of motor nervous system • Effect of posture / exercise on pulse and blood pressure

Minor experiments - • Estimation of Hemoglobin • Packed cell volume • Erythrocyte sedimentation rate • Blood groups – Rh factor, ABO system • Osmotic fragility of blood • Specific gravity of blood • Bleeding time and clotting time • Respiratory efficiency test (spirometry / peak flow meter) • Recording of respiratory movements with stethograph • Clinical examination of any one or more cranial nerves • Clinical examination of superficial reflexes • Clinical examination of deep reflexes • Cerebellar function tests

Charts - • Discussion of comments – problem oriented • Discussion of calculations

F. SCHEME FOR CONDUCTING PRACTICAL EXAMINATION

- Practical I (40 Marks) – Hematology major experiment (20 Marks), Hematology minor experiment (10 Marks), Chart – comment (5 Marks), Calculation / OSPE Skill (5 Marks)
- Practical II (40 Marks) – Clinical physiology major experiment (20 Marks), Clinical physiology minor experiment (10 Marks), Chart – comment (5 Marks), Calculation / OSPE Skill (5 Marks)

G. RECOMMENDED BOOKS

1. Text Book of Medical Physiology – Guyton & Hall – WB Saunders
2. Review of Medical physiology – W.F. Ganong – Lange Medical
3. Text Book of Human Physiology – Sharadha Subramaniam – Chand & Co
4. Concise Medical Physiology – Chaudhuri – New Central Book Agency (P) Ltd
5. Text Book of Physiology Vol. I & II – A.K. Jain – Avichal Publishing Company
6. Physiological Basis of Medical Practice – Best & Taylor – Williams & Wilkins
7. Human Physiology – The Mechanism of Body function – Vander, Sherman, Luciano – McGraw Hill
8. Physiology – Bern and Levy – Mosby
9. Human Physiology – Sembulingam
10. Text Book of Practical Physiology – GK Pal and Pravatipal – Orient Longman
11. A Text Book of Practical Physiology – C.L. Ghai – Jaypee
12. A Text Book of Practical Physiology – V.G. Ranade – Pune Vidyathi Griha Prakashan

BIOCHEMISTRY

A. GOAL

The broad goal of the teaching of undergraduate students in biochemistry is to make them understand the scientific basis of the life processes at the molecular level and to orient them towards the application of the knowledge acquired in solving clinical problems.

B. OBJECTIVES

At the end of the course, the student shall be able to:

- Describe the molecular and functional organization of a cell and list its subcellular components
- Delineate structure, function and inter-relationships of biomolecules and consequences of deviation from normal
- Summarize the fundamental aspects of enzymology and clinical application wherein regulation of enzymatic activity is altered
- Describe digestion and assimilation of nutrients and consequences of malnutrition
- Integrate the various aspects of metabolism and their regulatory pathways
- Explain the biochemical basis of inherited disorders with their associated sequelae
- Describe mechanisms involved in maintenance of body fluid and pH homeostasis
- Outline the molecular mechanisms of gene expression and regulation, the principles of genetic engineering and their application in medicine
- Summarize the molecular concept of body defences and their application in medicine
- Outline the biochemical basis of environmental health hazards, biochemical basis of cancer and carcinogenesis
- Familiarize with the principles of various conventional & specialized laboratory investigations and instrumentation analysis and interpretation of a given data
- Suggest experiments to support theoretical concepts and clinical diagnosis
- Make use of conventional techniques / instruments to perform biochemical analysis relevant to clinical screening and diagnosis
- Analyze and interpret investigative data
- Demonstrate the skills of solving scientific and clinical problems and decision making

C. COURSE CONTENT

- Paper – I
- Molecular and functional organization of cell and its subcellular components
 - Chemistry, digestion, absorption and metabolism of carbohydrate and metabolic errors
 - Chemistry, digestion, absorption and metabolism of lipids and metabolic errors
 - Enzymes
 - Vitamins
 - Electron transport chain and biological oxidation
 - Nutrition
 - Porphyrins, haemoglobin and bilirubin metabolism
 - Integrated Metabolism
- Paper – II
- Chemistry, digestion, absorption and metabolism of protein and inborn errors of metabolism
 - Chemistry and metabolism of Purine nucleic acids and errors of metabolism
 - Molecular biology
 - Water, electrolytes
 - pH and its regulation
 - Cancer and xenobiotics
 - Minerals
 - Hormones
 - Laboratory instrumentation, Functional tests and interpretation
 - Immunoglobulin

D. THEORY

Paper - I

1. Molecular and functional organization of cell and its subcellular components
 - The structure of cell and intracellular components

- The structure and functions of Plasma membrane, cytosol, Endoplasmic reticulum, Organelles like Nucleus, Mitochondria, lysosomes, Ribosomes, Golgi apparatus, peroxisomes, cytoskeleton
 - The composition of nucleosomes
 - A brief account of the sub cellular fractionation and markers of each organelle and fraction
2. Chemistry, digestion, absorption and metabolism of carbohydrate and metabolic errors
- Structure and functions of Carbohydrates – Glucose, Fructose, Galactose, Pentoses, Lactose, Maltose, Sucrose, Cellulose, Starch, Glycogen, Glycosamino glycans, Glycoproteins, blood group antigens – Chromatographic separation of mono and disaccharides
 - Digestion and absorption of carbohydrates, absorption of sugars, Digestive Enzymes > Clinical: Lactose intolerance – Acute pancreatitis, Osmotic diarrhea, Cholera > The Citric Acid Cycle – Catabolism of acetyl CoA > Glycolysis, Gluconeogenesis, Pentose Phosphate Pathway, metabolism of Glycogen, metabolism of Fructose and Galactose, Maintenance of Blood Glucose > Clinical: Diabetes Mellitus, Glucose Tolerance test, Glycosuria, Essential Fructosuria, Fructose Intolerance – Galactosemias – Glycogens storage disorders
3. Chemistry, digestion, absorption and metabolism of lipids and metabolic errors
- Structure and functions of Lipids – Fatty acids – Saturated, unsaturated, polyunsaturated acids, glycolipid, Triacyl glycerol, Cholesterol, Phospholipids, gangliosides, Eicosanoids, Membrane structure, Fluid Mosaic Model of membrane, membrane transport – Digestion and Absorption > Lipoproteins > Clinical: Surfactant, Liposomes
 - Digestion of lipids – Role of Bile salts and bile on lipid digestion and absorption, formation of Chylomicrons and lymphatic entry of lipids into circulation, absorption of fat soluble vitamins > Fatty acid oxidation (beta, alpha and omega) Metabolism of Propionyl CoA, Fatty acid Biosynthesis, ketone bodies synthesis and breakdown – Metabolism of Eicosanoids, Lipoproteins metabolism, Cholesterol synthesis and its control – Compounds derived from cholesterol – Tri glyceride Synthesis and storage > Clinical: Diabetic Ketosis, Starvation ketosis, hyperlipidemias, lipid profile – values interpretation

4. Enzymes

- Enzyme – Nomenclature, Classification, Structure, Cofactor, Enzyme turnover (half life), Intracellular location of enzymes, General properties – Effect of Temperature and pH, Active site, Zymogen activation, Isozymes, Specificity, K_M , its role in the activity of enzyme in different tissues – Enzyme inhibitors > Enzyme regulation: Allosteric, feedback regulations, Product inhibition, Rate limiting enzymes – Constitutive and inducible enzymes, Covalent modifications > Clinical: Enzymes in clinical diagnosis

5. Vitamins

- Water Soluble Vitamins: > Source, absorption, metabolism and coenzyme functions of Thiamine, riboflavin, Biotin, Niacin, Pantothenic acid, Pyridoxine > Their deficiency manifestations – Their recommended Dietary Allowances > Ascorbic acid: Source, coenzyme functions, its role in collagen synthesis, reducing properties, Antioxidant properties, Hydroxylation reactions, Deficiency manifestations, scurvy, RDA > Folic acid, source, its role in one Carbon metabolism and Purine synthesis > Megaloblastic anemia, RDA > Cobalamin, source, absorption, storage, coenzyme functions, Folate trap, Deficiency manifestations, RDA
- Fat Soluble Vitamins: > Beta Carotene – its antioxidant property, its role as a provitamin > Vitamin A – The three forms of the vitamin, conversion of carotenes to Vitamin A, absorption, storage and transport in plasma – Visual Pigments, the chemistry of vision and colour vision, Deficiency manifestations, night blindness, RDA, Hypervitaminosis A > Vitamin D – Active forms, Role of skin, liver and kidney in the synthesis of calcitriol – The role of calcitriol in calcium and phosphorus maintenance with the help of PTH – The deficiency manifestations - rickets – Hyper and Hypoparathyroidism – Hypervitaminosis D > Vitamin E – source, RDA and functions of E – Role of Selenium and Vitamin E function – Its role in glutathione peroxidase > Vitamin K – source, RDA, Gamma-carboxy glutamate residues and its role in calcium binding – Vitamin K Dependent proteins and Coagulation factors – Anti Vitamins

6. Electron transport chain and biological oxidation

- Bioenergetics, the role of ATP, Biologic Oxidation, the respiratory chain and oxidative phosphorylation

7. Nutrition

- Major nutrients, BMR, energy derived from carbohydrates, fats and proteins – SDA, Dietary fibres > Clinical: Protein calorie malnutrition,

protein malnutrition – Kwashiorkor and Marasmus – Their diagnosis and dietary correction > Obesity

8. Porphyrins, haemoglobin and bilirubin metabolism

- Hemoglobin, Chemistry of respiration, fetal and embryonic hemoglobins – Role of 2, 3 bisphosphoglycerate – Bohr effect, binding of Oxygen, Carbon-di-oxide and Hydrogen ion in the Hemoglobin molecule – Forms of hemoglobins present in adults, Abnormal Hemoglobins, Positive Co-operativity, the ability of hemoglobin to accept and deliver Oxygen > Clinical: Haptoglobins, Sickle cell disease, Thalassemias, Carbaminohemoglobin, Methemoglobin > Heme synthesis, Breakdown of Hemoglobin, Bilirubin metabolism, Jaundice, Porphyrins

9. Integrated Metabolism

- Metabolic Integration – Fate of Glucose-6 Phosphate, Acetyl CoA > Metabolic adaptations in fed state, starvation – Metabolism in specific tissues and organs – RBC, liver, muscle, heart, brain, adipose tissue, Control operating in all the metabolic pathways

Paper - II

1. Chemistry, digestion, absorption and metabolism of protein and inborn errors of metabolism

- Structure of amino acids – Classification of amino acids, their properties and significance, Peptide bond formation – Amino acids that are present in proteins – Amino acids that are not present in proteins > Structure of Proteins: General, Three dimensional structure of specific proteins with their structure and the suitability of their structure to their functions – Myoglobin, Hemoglobin, Primary structure determination, Insulin, Collagen, Elastin, naturally occurring peptides > Clinical: Muscle injury and myocardial infarction – Myoglobinuria – Emphysema the Collagen and elastin changes in the lungs – Ascorbic acid deficiency – Collagen abnormalities – Lysyl Oxidase – Lathyrism and role of copper, Separation technique – Electrophoresis and chromatography – Plasma proteins and their functions – Electrophoresis patterns of Cirrhosis of liver, Nephrotic syndrome, Multiple Myeloma when compared to normal
- Digestion of proteins – mechanism of amino acids absorption > Catabolism of proteins, Transamination and Deamination reactions, disposal of the amino nitrogen, Catabolism of the carbon skeleton of Tyrosine, Phenyl Alanine, Branched chain amino acids, Methionine and

transmethylation reactions, Tryptophan, Histidine – Specialised compounds derived from amino acids > Clinical: Hyperammonemias, Phenyl Ketouria, Albinism, Maple Syrup urine disease, Alkaptonuria, homocystinuria, Hartnup disease – BUN, Plasma Urea levels, Serum creatinine levels – Their use in kidney function evaluation

2. Chemistry and metabolism of Purin nucleic acids and errors of metabolism
 - Structure and functions of Nucleic acids – Purines and pyrimidines, Nucleosides, Nucleotides, RNA, DNA, Histones – Their role in DNA arrangement in Chromosomes – Genes – Synthesis and breakdown of purine and pyrimidine – Errors of metabolism

3. Molecular Biology
 - DNA organization, Replication and repair, Histones, Nucleosomes, Chromosomes, Mutations with Protein Synthesis, Inheritance
 - RNA - different RNAs their synthesis, Processing and Modification, Exons and Introns, Ribozymes
 - Protein Synthesis and the Genetic Code, Mutations – Point mutations, Frame shift, Missense
 - Nonsense Mutations
 - Suppressor tRNA molecules and their role in mutations
 - Post translational modifications with examples
 - Antibiotics and their effect on Translation
 - Regulation of GENE expression: Enhancers, repressors, binding of regulatory proteins to DNA – Operon hypothesis
 - Recombinant DNA technology and its application, Blot techniques and their applications
 - Polymerase chain reaction, Prenatal Diagnosis, Restriction Fragment Length polymorphism, Gene therapy, Transgenic animals, Reverse transcription, Human Genome projects Polymorphism

4. Water and Electrolytes
 - Intracellular and extracellular electrolytes, maintenance of Body water, Electrolyte balance

5. pH and its Regulation
 - Maintenance of pH – the role of blood buffers, Respiratory control, Role of the Kidney – Acidosis, Alkalosis, their diagnosis – The compensatory mechanisms – Osmolality, Anion gap and blood Gas measurements – Their clinical use
6. Cancer and Xenobiotics
 - Environmental health hazards, Biochemistry of Cancer and carcinogenesis – Occupational hazards, environmental pollutants
 - Carcinogens, Cell cycle control, oncogenes, mutagenesis, Tumor markers, Anticancer agents, Tumor suppressor genes, Growth Factors, Apoptosis
 - Xenobiotics – Detoxification
7. Minerals
 - Mineral metabolism: Calcium Phosphorus, Iodine, Zinc, Iron, Copper, Magnesium, Selenium and other trace minerals, etc.
8. Hormones
 - Mechanisms of hormone action
9. Laboratory instrumentation, Functional tests and interpretation
 - Immuno Assay – ELIZA, RIA – Isotopes
 - Instruments – Colorimeter – principles, Components, Uses > Spectrophotometer – Principles, Components, Uses > Auto analyzer – Principle, Components, Uses
 - Liver function tests, Kidney function tests, CSF, Thyroid, Exocrine pancreas, Cardiac Markers
10. Immunoglobulin
 - Immunoglobulins – Structure, different types, their major functions, Monoclonal antibodies – Synthesis – Hyper and hypo gamma globulinemias – Immune deficiency

E. PRACTICAL

1. Reactions of carbohydrates to identify – Mono, di and polysaccharides
 - Tests – Molish, Benedict's, Barfoed's, Foulger's, Seliwanoff's, Bial's
 - Starch – Iodine test, Benedict's hydrolysis – followed by Benedict's and iodine test
2. Reactions with proteins – Precipitation with half and full saturation salt solutions – Heat coagulation test, colour reaction for amino acids – Albumin, Casein • Milk analysis to record calcium, Phosphorus, Lactose
3. Spectroscopy and derivatives of Hemoglobin
4. Constituents of normal urine
5. Abnormal constituents of urine – Protein, Reducing sugar, blood, acetone, Bile salt, Bile pigments
6. Quantitative experiments – Estimation of • Plasma Glucose • Plasma Urea
 - Serum total proteins • Serum Creatinine • Serum Uric Acid • Serum Phosphorus

F. CHARTS

1. Metabolic Acidosis and Alkalosis
2. Respiratory Acidosis and Alkalosis
3. Abnormal GTT – Mild Diabetes, Severe Diabetes with Ketosis, Renal Glycosuria, Alimentary Glycosuria
4. Diagnosis with Biochemical Findings -
 - Starvation • Nephrotic Syndrome
 - Acute Renal Failure • Myocardial Infarction – 12 hours / 48 hours • Acute Pancreatitis • Jaundice – Hemolytic, Hepatic, Obstructive • Thyroid – Hypo and Hyper Thyroidism • Parathyroid – Hypo and Hyper Parathyroidism
5. Vitamin Deficiency: • Vitamin A • Thiamine • Riboflavin • Pyridoxine • Folic acid • cyanocobalamin • Ascorbic Acid • Calcitriol
6. Inborn Errors of Metabolism: • Von Gierke's Disease • Niemann Pick's Disease • Galactosemia • Phenyl Ketonuria • Alkaptonuria • Maple Syrup Disease • HGPRT deficiency • Refsum's disease
7. Hyper Lipoproteinemia – Type I and Type II

G. SPOTTERS

1. Serum Protein Electrophoresis Pattern – Normal, Nephrotic Syndrome, Cirrhosis Liver, Multiple Myeloma
2. Identification of Hemoglobin Derivatives using Spectroscope – Oxy, reduced and Methemoglobin
3. Identification of Hemi crystals, Osazones of glucose, fructose, maltose, lactose
4. Nutrition – Identify source for Beta carotene, Ascorbic acid, Iron, Folic acid
5. The biological values for the proteins present in Egg and Milk
6. Chromatogram of Phenyl Ketonuria
7. Electrophoretic patterns – Normal serum proteins, Nephrotic syndrome (Serum Proteins) Cirrhosis liver, Multiple Myeloma
8. Urinometer
9. Colorimeter
10. pH meter
11. Centrifuge
12. Reagents
13. Structure of Cholesterol, Monosaccharides – glucose, fructose, galactose, disaccharides – lactose, sucrose, maltose, mRNA, tRNA, Purine, Pyrimidine, Amino acids, Glutathione

H. SCHEME FOR CONDUCTING PRACTICAL EXAMINATION

- Qualitative analysis (20 Marks) – Identification (5 Marks), Discussion (15 Marks)
- Quantitative analysis (30 Marks) – Procedure (10 Marks), Values (5 Marks), Discussion (15 Marks)
- Charts (20 Marks) – 5 Charts
- Spotters (10 Marks)

I. RECOMMENDED BOOKS

1. Text Book of Biochemistry – D.M. Vasudevan – Srrekumar S
2. Biochemistry – Stryer
3. Illustrated Biochemistry – Lippincott
4. Review of Biochemistry – Harper
5. Text Book of Biochemistry with clinical correlation – Devlin
6. Fundamentals of Biochemistry – Voet, Pratt
7. Principles of Biochemistry – Lehninger
8. Biochemistry – Case Oriented Approach – Montgomery