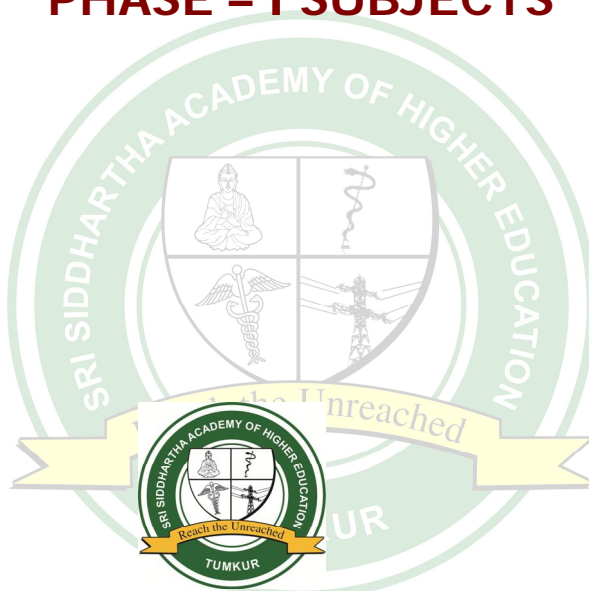


MEDICINE

MBBS DEGREE COURSE & CURRICULUM

PHASE – I SUBJECTS



Sri Siddhartha
Academy of Higher Education
Deemed-to-be-University
Accredited 'A' Grade by NAAC

Established under Section 3 of the UGC Act, 1956
MHRD, GOI No. F.9-31/2006-U.3 (A) Dtd. 30th May 2008

Agalakote, B.H. Road, Tumkur – 572107, Karnataka, India

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SECTION – I

INTRODUCTION

The Medical Council of India (MCI) revised the M.B.B.S curriculum. It came into effect from May 1997. Sri Siddhartha University implemented the new regulations for the batches of students admitted to the M.B.B.S course for the academic year 2008-09.

The new regulations recommended:

- (1) That the Medical curriculum should be oriented towards educating students to take up the responsibilities of physicians for first contact. The medical graduate should be capable of functioning independently in both urban and rural environment.
- (2) Every effort should be made to provide educational experience that allows hand-on-experience both in hospital as well as in community setting. For this purpose, a comprehensive list of clinical skills that a graduate must acquire at the end of the course including internship has been prepared.
- (3) That maximum efforts be made to encourage integrated teaching and every attempt be made to de-emphasize compartmentalization of disciplines so as to achieve horizontal and vertical integration in different phases.
- (4) That educational experience should emphasize health rather than only disease, and community orientation also instead of only hospital orientation. Population control and family planning should also be given due emphasis.
- (5) Due importance to be given to teaching common problems of health and diseases and to the national programmes.
- (6) That every effort should be made to use learner oriented methods which would encourage cultivation of logical thinking, clarity of expression, independence of judgment, scientific habits, problem solving abilities, and self-directed learning.
- (7) Reduction of "didactic lectures (not more than 1/3 of total teaching hours) and increasing use of active methods of learning such as group discussion seminars, role play, field visits, demonstrations, peer interactions etc. which would enable students to develop personality, communication skills and other qualities which are necessary.
- (8) Examination be designed with a view to assess not merely the knowledge but also practical and clinical skills, habits and values which are necessary for a graduate to carry out professional day to day work competently.
- (9) Regular periodic assessment be done throughout the course for internal assessment. The assessment need not be limited to written tests. It should relate to other items such as maintenance of records, participation in seminars and group discussions, clinical case study, proficiency in carrying out practical or clinical skills or participation in projects and assignments (even) during vacation. These be evaluated objectively and recorded.

- (10) That every medical institution should evolve institutional objectives, which would be in consonance with the national goals (see section II) and health policy. The institutional objectives should describe the attributes of their product.
- (11) Shift in the role of medical teachers form mere imparting knowledge to that of a facilitator and motivator of student learning.
- (12) That every medical college establishes a medical education unit for faculty development, preparation learning resource materials and improved evaluation methods.

Sri Siddhartha University endorses these recommendations. It strongly desires that affiliated colleges should implement these while conducting the MBBS course.

Doctors and other health professionals are confronted with many ethical issues and problems. With advances in science and technology, these problems are on the increase. It is necessary every doctor to be aware of these problems. The doctors should also be trained to analyze ethical problems as they arise and deal with them in an acceptable manner. It is therefore recommended that teaching of medical ethics be introduced in phase I and continued throughout the course including the internship period.

In order to implement the new regulations, from the academic year of 2008-09 it was necessary for this university to restructure the I MBBS course. Accordingly ordinances were published phase I subjects in 2008 and subjects in this revised edition (2004) the amendments made by the Medical Council of India from time to time since 2008 have been incorporated. The goals and general objectives of MBBS education are given in Section II. The eligibility for admission , duration of the course, attendance, internal assessment, distribution marks of phase I professional examination subjects, criteria for pass, and grounds migration are given in the regulations. Revised course contents of subjects of (syllabi) phase I teaching schedule and scheme of examination are given.

SECTION – II

OBJECTIVES OF EDUCATION STATED IN MCI REGULATIONS, 1997

The MCI has stated the goals and general objectives of graduate medical education in the new regulations. They are given in this section. It is desired that in consonance with these national goals, each medical college should evolve institutional objectives.

1. National Goals :

At the end of undergraduate program, the medical students shall endeavour to be able to :

- a) Recognize 'health for all' as national goal and health right of all citizens and by undergoing training for medical profession fulfill his/her social obligations toward realization of this goal;
- b) Learn every aspect of National policies on health and devote himself/herself to its practical implementation ;
- c) Achieve competence in practice of holistic medicine, encompassing primitive, preventive, curative and rehabilitative aspects of common diseases;
- d) Develop scientific temper, acquire educational experience for proficiency in Profession and promote health living;
- e) Become exemplary citizen by observation of medical ethics and fulfilling social and professional obligations, so as to respond to national aspirations.

2. Institutional Goals

The under graduate students coming out of a medical institution should :

- a) Be competent in diagnosis and management of common health problems of individual and community, commensurate with his/her position as a member of the health team at the primary, secondary or tertiary levels, using his/her clinical skills based on history, physical examination and relevant investigations;
- b) Be competent to practice preventive, promotive, curative and rehabilitative medicine in respect to the commonly encountered health problems.
- c) Appreciate for different therapeutic modalities, be familiar with the administration of "essential drugs" and their common side effects;
- d) Be able to appreciate the social-psychological, cultural, economic and environmental factors affecting health and develop humane attitude towards the discharging one's professional responsibilities.
- e) Possess the attitude for continued self learning and to seek further expertise or to pursue research in any chosen areas of medicine; Be familiar with the basic factors, which are essential for the implementation of National Health Programs including practical aspects of the following;
 - 1) Family welfare and Maternal and Child Health (MCH)
 - 2) Sanitation and water supply.
 - 3) Prevention and control of communicable and non-communicable diseases.
 - 4) Immunization,
 - 5) Health Education;
- f) Acquire basic management skill in the area of human resources, materials and resource management related to health care delivery;

- g) Be able to identify community health problems and learn to work to resolve these by designing, instituting corrective steps and evaluating outcome of such measures;
- h) Be able to work as a leading partner in health care teams and acquire proficiency in communication skills.
 - 1) Be competent to work in a variety of health care settings
- i) Have personal characteristics and attitude required for professional life such as personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals.
- j) All efforts must be made to equip the medical graduate to acquire the detailed in Appendix B for Medical Council of India Regulations on Medical Education, 1997.

3. Departmental Goals & Objectives

HUMAN ANATOMY

i). Goal

The broad goal of the teaching of undergraduate students in Anatomy aims at comprehensive knowledge of the gross and microscopic structure and development of human body to provide basis for understanding the clinical correlation of organs or structures involved and anatomical basis for the diseases presentations.

ii). Objectives

A) Knowledge.

At the end of the course the students shall be able to :

- a) Comprehend the normal disposition, clinically relevant interrelationships, functional and cross sectional anatomy of the various structure in the body;
- b) Identify the microscopic structure and correlate elementary ultra structure of various organs and tissues and correlate the structure with the functions as a prerequisite for understanding the altered state in various diseases processes;
- c) Comprehend the basis structure and connections of the central nervous system to analyse the integrative and regulative functions of the organs and systems. He/she shall be able to locate the site of gross lesions according to the deficits encountered;
- d) Demonstrate knowledge of the basic principles and sequential development of the organs and systems, recognized the critical stages and development and effects of common teratogens, genetic mutations and environmental hazards. He/she shall be able to explain the developmental basis of the major variations and abnormalities.

B. Skills

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

- a) Identify and locate all the structures of the body and mark the topography of the living anatomy;
- b) Identify the organs and tissues under the microscope;
- c) Understand the principles of karyotyping and identify the gross congenital anomalies;
- d) Understand principles of newer imaging techniques and interpretation of

- Computerized Tomography(CT) scan, sonogram etc.,
- e) Understand clinical basis of some common clinical procedures i.e., intramuscular and intravenous injection, lumbar puncture and kidney biopsy etc.

C. Integration

From the integrated teaching of other basic sciences, students shall be able to comprehend the regulation and integration of the functions of the organs and systems in the body and thus interpret the anatomical basis of disease process.

HUMAN PHYSIOLOGY INCLUDING BIO PHYSICS

(A) Physiology

i. Goal

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

ii. Objectives

a. Knowledge

- Explain the normal functioning of all the organs systems and their interactions for well co-ordinated total body function;
- Assess the relative contribution of each organ system to the maintenance of the milieu interior;
- Elucidate the physiological aspects of normal growth and development;
- Describe the physiological response and adaptations to environmental stresses;
- List physiological principles underlying pathogenesis and treatment of disease.

b. Skills

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

- Conduct experiments designated for study of physiological phenomena;
- Interpret experimental/investigative data;
- Distinguish between normal abnormal data derived as a result of tests, which he/she has performed and observed in the laboratory.

c. Integration

At the end of the integrated teaching the student shall acquire an integrated knowledge of organ structure and function and regulatory mechanisms.

(B) BIO PHYSICS

- Physical principles of transport across cell membrane and across capillary wall.
- Biopotentials
- Physical principles governing flow of blood in heart and blood vessels.

BIOCHEMISTRY

Biochemistry including medical physics and molecular biology

i. 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.

ii. Objectives

a. Knowledge

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

1. Describe the molecular and functional organization of a cell and list its subcellular components;
2. Delineate structure, function and inter-relationships of biomolecules and consequences of deviation from normal;
3. Summarize the fundamental aspects of enzymology and clinical application where in regulation of enzymatic activity is altered;
4. Describe digestion and assimilation of nutrients and consequences of malnutrition;
5. Integrate the various aspects of metabolism and their regulatory pathways;
6. Explain biochemical basis of inherited disorders with their associated sequelae;
7. Describe mechanisms involved in maintenance of body fluid and pH homeostasis;
8. Outline the molecular mechanisms of gene expression and regulation, the principle of genetic engineering and their application in medicine.
9. Summarize the molecular concept of body defences and their application in medicine.
10. Outline the biochemical basis of environmental health hazards, biochemical basis of cancer and carcinogenesis;
11. Familiarize with principles of various conventional and specialized laboratory investigations and instrumentation analysis and interpretation of a given data;
12. Suggest experiments to support theoretical concepts and clinical diagnosis.

b. Skills

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

1. Make use of conventional techniques / instruments to perform biochemical analysis relevant to clinical screening and diagnosis;
2. Analyse and interpret investigative data;
3. Demonstrate the skills of solving scientific and clinical problems and decision making.

c. Integration

The knowledge acquired in biochemistry shall help the students to integrate molecular events with structure and function of the human body in health and disease.

SECTION - III

CURRICULUM OF PHASE 1 MBBS DEGREE COURSE.

DURATION OF THE COURSE:

Every student shall undergo a period of certified study extending over 4 and half years from the date of commencement of his study for the subject comprising the medical curriculum to the date of completion of the examination followed by one year compulsory rotating internship. The 4 and ½ course has been divided into three phases.

1. Phase 1-1 year, consisting of two terms of 6 months each.
2. Phase 2-1 and ½ years, consisting of 3 terms of 6 months each.
3. Phase 3-3 and ½ years, after Phase -1, consisting of 7 terms.

The first year will be occupied in the study of preclinical subjects.

- Human Anatomy (735 hours).
- Physiology and Biophysics (480 hours).
- Biochemistry (300 hours).
- Introduction to community medicine (60 hours).

A detailed syllabus is given in following sections.

ACADEMIC TERMS:

Academic term will start from the first week of August to 31st of July succeeding year. All candidates admitted beyond the last date stipulated by the university shall have to appear for Professional Examination to be held subsequent to the regular examination after completion of the prescribed duration.

MID TERM VACATION will start from DEC 20th to JAN 5th of every year.

ATTENDANCE:

Every candidate should have attendance not less than the 75% of the total classes conducted in theory and practicals in each calendar year calculated from the date of commencement of the term to the last working day as notified by the university in each of the subjects prescribed to be eligible to appear for the university examination. (vide Medical Council of India Notification on Graduate Medical Education (Amendment) Regulations 2003, published in the Gazette of India part 3, Section 4, Extraordinary issued on 15 the October 2003)

Fresh classes will be conducted for repeaters and 75 % attendance is compulsory for them to appear for university examination.

Shortage of attendance of the students must be informed to the parents or guardian.

Attendance to be calculated every quarterly and notified in concerned departments.

The Principal should notify at the college the attendance details at the end of each term without fail under intimation to the university.

A candidate lacking in the prescribed attendance and progress in any subject(s) in theory or

practical in the first appearance should not be permitted to appear for the examination in that subject(s)

TEACHING HOURS.

PHASE-1

TABLE -1.Distribution of teaching hours in phase-1 subjects.

Methods	Subjects			
	Anatomy	Physiology	Biochemistry	Community Medicine
Lecture	5hrs Per Week	160 hrs	180 hrs	40 hrs
Tutorials	1 hr Per Week	80 hrs	20 hrs	10 hrs
Group Discussion	1 hr Per Week	80 hrs	20 hrs	4 hrs
Practical /Demonstration	4 hrs Per Week	240 hrs	80 hrs	6 hrs
Dissection	10hrs Per Week	-	--	--
Total	735 hrs	480 hrs	300 hrs	60 hrs

Seminars will be conducted once in a Month and integrated teaching once in 3 Months

Coordinated Programme for MBBS phase 1 of 1 year course in anatomy, physiology & biochemistry

Month	Anatomy	Physiology	Biochemistry	Integrated teaching
1	General anatomy General embryology General histology General human genetics	General physiology Cell membrane, transport Homeostasis body fluids Biophysical principles	Cell structure Subcellular components Biophysical principles PH, buffers Biochemistry of nucleic acids	
2&3	Upper limb and lower limb dissection	Haematology Muscle physiology	Classification sources & functions of proteins carbohydrates & lipids	Anemia
4	Thorax and systemic embryology	Cardiovascular system Respiratory system	Plasma protein, protein synthesis, diagnostics enzymology	
5&6	Abdomen & genitourinary organs with systemic embryology pelvis	Digestive system Secretion and motility renal & reproductive physiology	Digestive enzymes Vitamins, digestion & absorption of food, liver function, detoxification, renal function, gastric function	Jaundice
7&8	Head & neck, brain	CNS , ANS, endocrine glands	Metabolism of carbohydrates aminoacids, proteins, fats, minerals, water	Endocrine and exocrine pancreas (diabetes mellitus) Anatomy+ physiology+ Biochemistry
9&10	Brain, cerebral cortex, ventricular system, brain coverings, limbic system	Higher functions, emotions, behaviour	Neurotransmitters, radioisotopes, biological, oxidation, electron transport cycle	CSF Anatomy+ physiology + Biochemistry

SCHEME OF EXAMINATION:

INTERNAL ASSESSMENT:

It shall be based on evaluation of assignment, preparation of seminar, participating in group discussion. Regular periodic examinations should be conducted through out the course. There should be a minimum of at least **three** sessional examinations during Phase 1 of the course. Average of **All The Examination Marks** should be considered while calculating the marks for internal assessment. Day to day records should be given importance in the internal assessment. The weightage given to internal assessment is 20% out of total marks assigned to the subject.

A student must secure **at least 35%** of total marks fixed for internal assessment in a particular subject in order to be eligible to appear in the university Examination of that subject.(vide Medical Council of India Notification on Graduate Medical Education(Amendment)Regulations 2003,published in the Gazette of India Part3,Section 4,Extraordinary issued on 15th Oct 2003).

Assistant professor and above or lecturer with 5 years of teaching experience can conduct Internal Assessment Examination. Paper record of the work should be maintained which will be the basis of all students internal assessment and should be available for scrutiny. The Internal Assessment marks of both theory and practical obtained by the candidates should be sent to the university at least 15 days prior to the commencement of theory examination.

PHASE-1

Internal Assessment for Anatomy, Physiology, Biochemistry.

Total marks: 80 (Theory-60 and Practicals-20)

THEORY:

Minimum of three examinations are recommended. The sessional examination preceding the university examination may be similar to the pattern of university examination **except for MCQs introduced for 20 marks. Average of all marks** obtained in the notified internal examination to be taken into consideration for calculating internal assessment. Total marks be reduced to 50 and 10 marks of formative assessment in the form of table testing in Anatomy and class tests in Physiology and Biochemistry were added to make a total of 60 marks and sent to the university. **Repeaters must attend the fresh IA** which will be separately conducted for them. **Marks of the new IA Exam will be considered.** Records are to be maintained and submitted before university examination.

PATTERN OF EXAMINATION.

Theory: 100 Marks each IA.

Long essay	- 2 x 10 marks = 20.
Short essay	- 8 x 5 marks = 40.
Short answers	- 10 x 2 marks = 20.
MCQs	- 20 x 1 marks = 20.

Average of 3 IA is taken and reduced to -- 50 marks.

Formative assessment is -- 10 marks.

TOTAL THEORY -- 60 MARKS.

PRACTICALS:

There will be **3 practical internal assessment** examinations and average of all shall be reduced to 20 marks and sent to the university. **Objective structured practical examination (OSPE) is introduced in all 3 subjects mainly to correlate the clinical knowledge.**

The internal assessment marks of both the theory and practical obtained by the candidates should be sent to the University atleast 15 days prior to the commencement of theory examination.

UNIVERSITY EXAMINATION-Subjects and Distribution of marks.

Phase-1

Table 3: Examination components, Subjects and Distribution of Marks.

Sl. No.		Anatomy	Physiology	Biochemistry
A.	THEORY			
1.	Written Paper No. of Papers & Maximum Marks for each Paper.	Two 2X100=200	Two 2X100=200	Two 2X100=200
2.	Viva – Voce	40	40	40
3.	Internal Assessment (Theory)	60	60	60
	Total Theory	300	300	300
B.	PRACTICALS			
1.	Practicals	80	80	80
2.	Internal Assessment (Practical)	20	20	20
	Total Practicals	100	100	100
GRAND TOTAL		400	400	400

THEORY:

There will be two theory papers of 100 marks each and duration of each paper will be of 3 hours.

Table 4: Type, number of questions and distribution of marks for written paper.

Type of Questions	Number of Questions	Marks of each Questions
Essay type Questions	2	10
Short Essay type Questions	10	5
Short Answer Question	10	3

Pass marks: paper minimum of 40% in each theory paper in each subject is mandatory to declare as pass.

Distribution of chapters for paper 1 and 2 with weightage of marks in university Examination.

ANATOMY:

Chapter wise distribution of questions & marks Paper- I with weightage of marks in university examination

Chapter / Topic	Type & no. of questions	Marks
Head & neck, brain& spinalcord, thorax, diaphragm, upperlimb also relevant systemic embryology	Long essay 2 X 10 marks	20
Head & neck, brain& spinalcord, thorax, diaphragm , upperlimb & general and systemic embryology and histology	Short essay 10X 5 marks	50
General anatomy, histology, embr, Head & neck, brain & spinal cord ,thorax, diaphragm, upperlimb also relevant systemic embryology & histology	Short answers 10X3 marks	30

Chapter wise distribution of questions & marks. Paper-II with he weightage of marks for University Examination

Chapter / Topic	Type & no. of questions	Marks
Gross anatomy of abdomen, pelvis, perineum & Lowerlimbs & relevant systemic embryology	Long essay 2 X 10 marks	20
Gross anatomy of abdomen, pelvis, perineum & lowerlimbs , relevant systemic embryology & histology & genetics	Short essay 10X 5 marks	50
Relevant systemic embryology, histology abdomen, pelvis ,perineum & lower limbs , & genetics	Short answers 10X 3	30

PHYSIOLOGY:

Distribution of chapters and suggested marks in parenthesis for Paper I and Paper II in Physiology for University examination are as follows:

Paper I

General Physiology (4), Blood (20), Cardiovascular system (24), Respiratory system (20). Gastrointestinal system (20), Renal system (12), (Note: Marks for Renal and Gastrointestinal system can be interchanged. (Figures shown in parentheses are weightage of marks recommended for the different topics).

Paper II

Endocrine (20), special senses (20), Reproduction (12), Central Nervous System (28), Muscle nerve (16), Skin and Body Temperature (4), (Note: Marks for Endocrines and Reproduction can be interchanged. (Figures shown in parentheses are weightage of marks recommended for the different topics).

The topics assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.

BIOCHEMISTRY

Biochemistry will have 2 papers of 100 marks each:

Division of Papers Marks

Weightage of

Paper – I (100 Marks)

- | | |
|--|------------|
| 1. Cell and sub cellular structures | (5 Marks) |
| 2. Chemistry of carbohydrates, proteins, lipids, nucleic acids. | (5 Marks) |
| 3. Digestion and absorption of carbohydrates, proteins, lipids, nucleic acids. | (5 Marks) |
| 4. Metabolism of carbohydrates, proteins, lipids and purines and pyrimidines. | (30 Marks) |
| 5. Enzymes, vitamins, minerals. | (20 Marks) |
| 6. Biological oxidation | (10 Marks) |
| 7. Intermediary metabolism | (5 Marks) |
| 8. Heme metabolism | (10 Marks) |
| 9. Metabolism of xenobiotics | (5 Marks) |
| 10. Nutrition | (5 Marks) |

Paper – II (100 Marks)

- | | |
|--|------------|
| 1. Acid Base Balance and its Disturbances | (10 Marks) |
| 2. Water and Electrolyte Balance and its Disturbances | (5 Marks) |
| 3. Radioactive Isotopes and their applications in Medicine | (5 Marks) |
| 4. Free radicals and Anti Oxidants | (5 Marks) |
| 5. Organ Function Tests. | (5 Marks) |
| 6. Plasma proteins, Immunoglobulins | (10 Marks) |
| 7. Biochemistry of Cancer | (5 Marks) |
| 8. Mechanism of Hormone action | (5 Marks) |
| 9. Molecular Biology | (15 Marks) |
| 10. Clinical Biochemistry including Clinical Enzymology | (30 Marks) |

PRACTICALS:

Total marks: 100 Final exam: 80, IA: 20.

ANATOMY:

Gross Anatomy:

- | | |
|--|-------------|
| a. Spotters: Identification of structures in a given specimen. | = 10 marks. |
| b. Discussion of 2 specimens and surface anatomy. | = 30 marks. |
| c. OSPE Stations 4, each station carry 4 marks. | = 16 marks. |

Histology:

- | | |
|-------------------------|-------------|
| a. 10 Spotters. | = 10 marks. |
| b. 2 Discussion slides. | = 14 marks. |

TOTAL

= 80 MARKS.

BIOCHEMISTRY: Total Marks = 100, Practicals = 80 Marks, IA = 20 Marks

- | | |
|-----------------------|-------------------------------|
| Quantitative analysis | = 15 marks. |
| Qualitative analysis | = 15 marks. |
| Clinical Biochemistry | = 50 marks. (5 OSPE stations) |
| TOTAL | = 80 MARKS. |

PHYSIOLOGY:

Practicals -1

- | | |
|---------------------------------|------------|
| a. Clinical examination | =15 marks. |
| b. Procedures on Human subjects | =15 marks. |
| c. 5 OSPE stations | =10 marks. |

Practicals -2 Haematology.

- | | |
|---|------------|
| a. Major experiment | =20 marks. |
| b. Minor experiment | =10 marks. |
| c. Interpretation of problem case history/charts. | =10 marks. |

TOTAL

=80 MARKS.

VIVA VOCE EXAMINATION: 40 MARKS.

ANATOMY:

The viva voce exam will be conducted by 4 examiners individually. The distribution of topics and for each examiner is as follows.

1. Questions on embryology with models	10 marks.
2. Radiological Anatomy with CT /MRI	10 marks.
3. Osteology and soft parts above diaphragm	10 marks.
4. Osteology and soft parts below diaphragm	10 marks.
TOTAL	40 MARKS.

PHYSIOLOGY:

The viva voce exam shall carry 40 marks and all examiners will conduct the examination.

Table 1-Portions of paper 1	20 marks.
Table 2- Portions of paper 2	20 marks.

BIOCHEMISTRY:

The viva – voce examination shall carry 40 marks and all the examiners will conduct the examination.

Portions of Paper I = 20 Marks
Portions of Paper II = 20 Marks

ELIGIBILITY FOR EXAMINATION

- Shall have under gone the approved course of study in the subject in prescribed duration.
- Shall have attended 75% of total classes in theory and practice's separately.
- Shall secure 35% of total marks fixed for I A in a particular subject.
- Those who fails in any subject/subjects of MBBS Phase I, has to put one academic term before she/he becomes eligible to appear for the next examination.
- Shall pass in all Phase – I (Pre-clinical) subjects, before joining the Phase – II (Para – clinical) subjects.

DECLARATION OF CLASS

- A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 75% of marks or more of grand total marks prescribed will be declared to have passed the examination with **Distinction**.
- A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 65% of marks or more but less than 75% of grand total marks prescribed will be declared to have passed the examination in **First Class**.
- A candidate having appeared in all subjects in the same examination and passed that examination in the first attempt and secures 50% of marks or more but less

than 65% of grand total marks prescribed will be declared to have passed the examination in **Second Class**.

- A candidate passing the University examination in more than one attempt shall be placed in **Pass Class** irrespective of the percentage of marks secured by him/her in the examination.

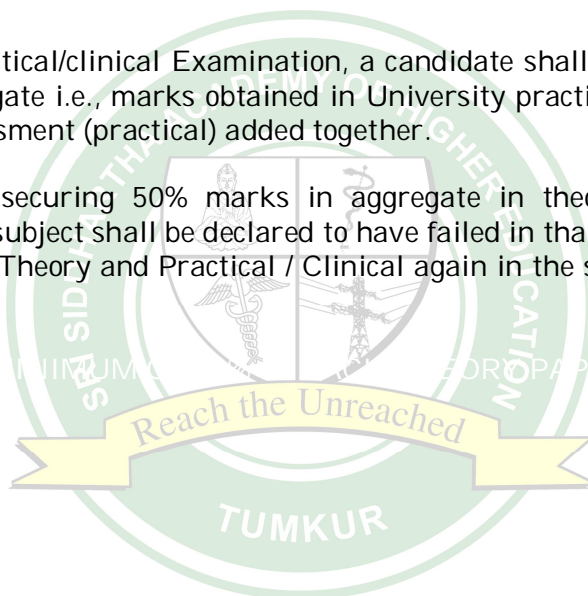
CRITERIA FOR PASS

For declaration of pass in any subject in the University examination, a candidate shall pass Both in theory and practical/clinical examinations separately as stipulated below:

The theory component consists of marks obtained in University written paper(s) viva-voce Examination and internal assessment (theory). For a pass in theory, a candidate shall secure Not less than 50 % marks in aggregate i.e., marks obtained in written examinations, viva-voce Examinations and internal assessment (theory) added together.

For a pass in practical/clinical Examination, a candidate shall secure not less than 50 % marks in aggregate i.e., marks obtained in University practical/clinical examination and internal assessment (practical) added together.

A candidate not securing 50% marks in aggregate in theory or practical/clinical examination. In a subject shall be declared to have failed in that subject and is required to appear for both Theory and Practical / Clinical again in the subsequent examination in that subject.



SECTION - IV

BIOCHEMISTRY

Course Contents

PAPER I (100 Marks)

THEORY

- I. Introduction, Scope and Concept of Medical Biochemistry in prevention, diagnosis and therapeutics of Diseases.
- II. **Cell and sub cellular structures ---- [Cell Biology] (3Hrs)**

Must know –

- a. Cell membrane – Composition
- b. Sub cellular structures and their Functions
- c. Transport across the Biological membranes – Active, Facilitated, Receptor Mediated Endocytosis.

Desirable to know – Disorders of transport mechanisms

Learning Objectives – Learner shall be able to describe, the molecular and functional organization of a cell and its sub cellular components, Mechanism of transport of various Biomolecules across the cell membranes.

a) Chemistry of:

Must Know:

i. Carbohydrates (4 Hrs)

– Definitions, Classifications, functions & Biological importance

1. Monosaccharides – Structure, Classifications & Properties (Isomerism, Stereoisomerism, etc,)
2. Oligosaccharides, Disaccharides - Structure & their importance
3. Polysaccharides – Homo & Heteropolysaccharides – Structure & their functions.

ii. Proteins, Amino Acids & Peptides : (6Hrs)

1. Proteins - Definition, Classifications & functions
2. Amino Acids – Classification, Properties, Side Chains of Amino Acids, Charge Properties
3. Peptides – Biologically active peptides – Egs such as GSH, Insulin – its structure.
4. Structural Organization, Conformation and Denaturation.
5. Biological importance

iii. Lipids : (4Hrs)

1. Definition, Classification, functions and Biological importance
2. Simple lipids - Triacylglycerols and waxes – structure and composition
3. Compound lipids – Phospholipids, Sphingolipids, glycolipids – Composition and functions.
4. Derived lipids – Fatty Acids – Saturated, Unsaturated, steriods, and their properties, Eicosanoids, Terpenes.

iv. Nucleic Acids : (4Hrs)

1. Definition & Biological importance
2. Classification and composition
3. Purine and pyrimidine bases, Nucleosides, Nucleotides
4. DNA – Structure and functions
5. RNA – Types, Structure and functions

Desirable to Know:

Carbohydrates – Glycoprotein's, Mucopolysaccharidosis

Proteins – Study of higher orders of protein structure

Lipids – Eicosanoids, Terpenes.

Nucleic Acids – Types of DNA

Learning Objectives – Learner shall be able to define, classify, describe the structure and functions and know the Biomedical importance of Biomolecules.

b) Digestion and Absorption of : (3 Hrs)

Must know – Carbohydrates, Lipids, proteins & Nucleic Acids
- Disorders related to digestion and absorption.

Learning Objective: Describe process of Digestion & assimilation of Nutrients and the associated Disorders.

c) Metabolism of :

i. Carbohydrates: (15 Hrs)

Must know –

1. Glycogenesis, Glycogenolysis and Glycogen storage Diseases
2. Glucose Transporters, Glycolysis, Rapaport Leubering cycle, Pyruvate oxidation and Citric Acid Cycle.
3. Pentose Phosphate Pathway
4. Uronic Acid Pathway
5. Gluconeogenesis and cori 's cycle
6. Metabolism of fructose and Galactose
7. Regulation of metabolic pathways
8. Disorders of carbohydrate metabolism
9. Regulation of Blood glucose.

ii. Lipids: (15 Hrs)

Must Know –

1. Oxidation of fatty Acids, Propionate metabolism, formation and Utilization of ketone bodies, Ketosis, Outline of the synthesis of cholesterol (reactions up to Mevalonate in detail) breakdown of cholesterol and metabolic disorders of Lipids.
2. Lipogenesis, de novo synthesis of fatty Acids, Chain elongation, desaturation, phospholipid Biosynthesis (Lecithin and cephalin only) and their breakdown.
3. Fatty liver and lipotropic factors.
4. Prostaglandins and their biological functions.
5. Plasma Lipoproteins – Classification, Functions and disorders.

iii. Proteins and Amino Acids: (15 Hrs)

Must know:

1. Breakdown of tissue proteins and amino Acid Pool, general reactions of Amino Acids.
2. Disposal of Ammonia – Urea Cycle, glutamate and glutamine formation.
3. Metabolism of Amino Acids (Glycine, Serine, Sulfur containing Amino Acids, Aromatic Amino Acids, Histidine and Arginine).
4. Metabolic disorders of Amino Acids, Aminoacidurias.
5. Synthesis of creatine, phosphocreatine, formation of creatinine and clinical Significance of Creatinine clearance.

iv. Purines and Pyrimidines : (4Hrs)

Must know:

1. Sources of atoms of purines and pyrimidine ring, Biosynthesis of Purine and Pyrimidine Nucleotides and their breakdown.
2. Salvage pathways.
3. Disorders of purine and pyrimidine metabolism.

Desirable to know:

Carbohydrates – Fructosamine, AGE's, Polyol Pathway, alcohol metabolism.

Lipids – Lipid storage diseases.

Proteins & Amino acids – Polyamines.

Learning Objectives: Describe and integrate metabolic pathways of various biomolecules and their regulation along with associated inborn errors of metabolism.

d) Enzymes : (10 Hrs)

Must know –

- Definition, Classification, Specificity, Co–Enzymes, Co– factors and activators.
- Mechanism of Enzyme action
- Factors affecting Enzyme activity, Km value and its importance
- Enzyme inhibitions - Competitive, Non Competitive Un- competitive, other types and their clinical application.
- Regulatory Enzymes – Pro Enzymes, Iso enzymes, Allosteric enzymes and feed back control.

Desirable to know: Enzyme assay, immobilized enzymes.

Learning Objective: Define, Classify and explain the mechanism of enzyme action, and factors affecting Enzyme activity and know the importance of Enzyme inhibition and Regulation of enzymes.

e) Vitamins: (10 Hrs)

Must know –

- Definition and Classification
- Brief account of Chemistry, Sources, Biochemical role, Deficiency diseases and Recommended dietary allowances (RDA), Hypervitaminosis.
- Anti Vitamins (Vitamin antagonists)

Desirable to know: Choline, Inositol (vitamin like substances)

Learning Objective: Learner shall be able to classify, know the sources, biochemical role , deficiency manifestations and RDA of vitamins.

f) Minerals : (4Hrs)

Must know –

specifically Biochemical role and clinical applications of,

Calcium, Phosphorous, Sodium, Potassium, Chlorides, Iron, copper Iodine, Zinc, Fluoride, Magnesium, Manganese & Selenium.

Desirable to know: Mo, Nickel, Chromium, Lithium.

Learning Objective: Describe the Biochemical functions, Sources, fate and Deficiency manifestations.

Biological Oxidation: (3Hrs)

Must know – Mitochondrial Electron transport chain, Oxidative Phosphorylation, Mechanism, Uncouplers & inhibitors.

Learning Objective – Learner shall be able to know the mechanism of energy production required as a fuel for various metabolic pathways.

g) Intermediary Metabolism: (2 Hrs)

Must know: Introduction, Methods of study of Intermediary metabolism.

Learning Objective - Learner shall be able to know about the methods of study of intermediary metabolism and metabolic inter relationships between different biomolecules.

h) Heme Metabolism : (5 Hrs)

Must know –

- Outline of Heme Biosynthesis, degradation of heme and functions of Normal Hemoglobin
- Abnormal Hemoglobins.

Learning Objective –

Describe the metabolism of Heme, its regulation and its Disorders.

i) Detoxification and Metabolism of Xenobiotics. (1 Hr)

Must Know: Mechanisms of Detoxification

Learning Objective – Explain the Biochemical aspects of Xenobiotics and Detoxification Process.

j) Nutrition and Energy metabolisms: (5Hrs)

Must know:

- BMR and its importance
- Calorific value of food, RQ, SDA, Balanced Diet
- Protein Energy malnutrition, Biological Value of Proteins, Nitrogen Equilibrium.
- Dietary fibres
- Metabolism in starvation

Learning Objective: Learner shall be able to know about the Biochemical importance of food its clinical significance.

PAPER II (100 Marks)

I Acid Base Balance and its disturbances: (5Hrs)

Must know

- P^H of Blood, its regulation- various mechanisms responsible for maintenance of Blood P^H
- Disorders of Acid Base Disturbances.

Learning objectives:-

Describe mechanisms involved in maintenance of Blood P^H and their disturbances.

II Water and Electrolyte Balance and its Disturbances: (2 Hrs)

Must Know: Distribution and regulation of water and Electrolytes in body fluid compartments and clinical applications.

Learning objectives:- Describe the mechanisms involved in distribution of water and electrolytes in various body fluid compartments and their disturbances

III Radioactive isotopes and their application in medicines: (1 Hr)

Must Know: Radioactive Isotopes and their applications in Research, Diagnostic and therapeutics

Learning objectives:- Explain the role of Radioactive isotopes in Research, diagnostic and therapeutic purpose.

IV Free Radicals and Anti Oxidants: (1 Hr)

Must Know: Generation and damage produced by Free Radicals, Free Radical Scavenger mechanisms and clinical significance. Lipid Peroxidation and Anti Oxidants

Learning objectives - Explain the role of free radicals and antioxidants in Health and disease process.

V Organ Function Tests: (3 Hrs)

Must Know:

Liver function tests
Kidney function tests
Thyroid function tests

Learning objectives: Explain the role of Organ function tests in Diagnosis of various Diseases.

VI Plasma proteins: (3 Hrs)

Must Know:

Separation, functions and importance of Plasma Proteins.
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Learning objectives: Describe the role of Plasma Proteins in maintenance of normal Homeostasis and its Clinical significance.

VII Immunoglobulins: (2 Hrs)

Must Know: Structure and functions

Learning objectives:

Summarize the basic aspects of immunology including body defence Mechanism

VIII Biochemistry of Cancer: (2 Hrs)

Must Know:

- a) Oncogenes
- b) Growth factors
- c) Tumour markers - Definition
Clinically important Tumour markers
Eg- CEA, alpha Feto protein (AFP)
HCG, Calcitonin, prostate specific Antigen

Learning objectives:

Explain the biochemical aspects of Carcinogenesis

IX Mechanism of Hormone Action: (2 Hrs)

Must know: Mechanism of signal transduction and functions of various Hormones.
Insulin, Glucagon, Epinephrine, Steroids

Learning objectives: Explain the basic mechanism of signal transduction and functions of various hormones.

X Molecular Biology: (15 Hrs)

Must Know:

- a) DNA, RNA Metabolism
- b) Replication, Transcription, Reverse Transcription and post transcriptional modifications
- c) Translation- Amino Acid activation, Initiation, Elongates and termination post translational modifications Regulation of Gene Expression
- e) Mutations
- f) Recombinant DNA technology, PCR & Gene therapy

Learning objectives: Describe the basic molecular mechanisms of organizations of genome, genetic expression and regulations, mutations, Genetic engineering and their applications in medicine

Clinical Biochemistry including clinical enzymology: (10 Hrs)

- 1) Diabetes Mellitus – Blood sugar values, GTT, Diagnostic and prognostic importance of glycated Hb.

- 2) Jaundice- Biochemical basis and distinguishing features of different types of Jaundice, laboratory diagnosis.
- 3) Porphyrrias- Causes and types of porphyrias, laboratory diagnosis
- 4) Diagnostic and therapeutic importance of enzymes
- 5) Ketosis
- 6) Principles of estimation of body fluids
- 7) Biochemical tests for atherosclerosis and MI
 - a) Lipid profile, apolipoproteins, homocysteine
C- Reactive protein
 - b) Ck – Total, CKMB, Troponins
- 8) SI Units, Quality control and standardization
- 9) Reference values and Interpretation of Blood glucose, Blood urea, Serum Creatinine, uric acid, Lipid profile, Calcium, Phosphorous, Bilirubin, Total proteins, albumin and A/G Ratio, Enzymes like AST, ALT, Alkaline phosphatase, Serum Electrolytes.
- 10) Instrumentation
- 11) Bio-Medical waste- Types, Potential risks and their safe management
- 12) Identify the principles of routine and specialised Biochemistry Laboratory Investigations and techniques, analysis and interpretation of Biochemical laboratory reports.

Learning objectives: Be accustomed to use basic devices for qualitative and quantitative Biochemical investigations and Interpretation of Laboratory Reports.

PRACTICALS

Part – I

a. Practicals to be performed by students

1. Reactions of Monosaccharides- Glucose and Fructose
2. Reactions of Disaccharides- Lactose, Maltose, Sucrose
3. Reactions of polysaccharides- Starch
4. Identification of unknown carbohydrates
5. Precipitation and coagulation reactions of proteins
6. Colour reactions of proteins: Albumin and Casein
7. Identification of unknown proteins
8. Identification of substances of physiological importance
9. Normal constituents of Urine
 - i) Organic: Urea, Uric acid and Creatinine
 - ii) Inorganic: Ca, P, Cl, SO_4 and NH_3 , Specific gravity
10. Analysis of abnormal urine
11. Spectroscopic examination of Hemoglobin derivatives and preparation of hemin crystals.
12. Spot test for PKU, Alkaptonuria and Homocystinuria.

Part – II

1. Estimation of blood glucose and interpretation
2. Estimation of blood urea and interpretation.
3. Estimation of serum inorganic phosphorus and interpretation
4. Estimation of serum Total Proteins, serum albumin and A: G ratio.
5. Estimation of urinary creatinine and interpretation of creatinine clearance.
6. Discussion of Biochemical aspects of various Diseases and Interpretation of Laboratory reports

b. Practicals for Demonstration only:

1. Colorimetry
2. Paper Chromatography
3. Paper Electrophoresis
4. Glucose tolerance tests
5. Determination of AST(SGOT) and ALT (SGPT)
6. Estimation of Serum Cholesterol (kit method)
7. Determination of ascorbic acid
8. Principle of flame photometry
9. Determination of glucose and proteins in CSF
10. Estimation of albumin in urine and test for Bence Jones proteins in urine.

Recommended Text Books and Reference Books

Text Books

1. Text book of Biochemistry by D. M. Vasudevan and SriKumari
2. Harpers Review of Biochemistry
3. Text Book of Biochemistry – A Clinically oriented approach – by Dr. Dinesh Puri

Reference Books

1. Principles of Biochemistry – LEHNINGER
2. Text Book of Biochemistry with Clinical correlations – DEVLIN
3. Biochemistry – STRYER
4. Biochemistry : A Case Oriented approach – MONTGOMERY

ANATOMY

SYLLABUS AT A GLANCE FOR MBBS PHASE-I COURSE IN ANATOMY

- **General Anatomy** : Cell & its organelles, cell division, Basic tissues of the body Terminology and nomenclature, History of Anatomy.
- **Elements of Anatomy** : Osteology, Anthrology, Myology, Angiology, Neurology.
- **Regional Anatomy** : Upper limb, Lower limb, Thorax- including diaphragm, Abdomen including Pelvis, Head and neck, Brain & spinal cord.
- **Gen-Embryology** : Development of individual organs & systems. Postnatal Growth & Development.
- **Histology** : General Histology, Microanatomy of individual organs & systems.
- **Human Genetics** : Principles of Human Genetics & Molecular biology.
- **Radiological Anatomy** : Skiagrams, Special X-rays & CT Scan.
- **Surface Anatomy** : In cadavers, In the living.
- **Sectional Anatomy** : Head & neck, Brain, Thorax, Abdomen including Pelvis.
- **Clinical Anatomy** : Clinically related discussions.
- **Bio-medical waste** : Types, potential risks & their safe management.

THEORY

I. GENERAL ANATOMY

Must Know

Subdivisions of Anatomy, Anatomical terms of position, terms of movement and Anatomical position., Colors used in Anatomical drawings. Structures met with Dissection – Skin superficial facial including its contents, deep fascia including its modifications,

Muscles origin, insertion, tendon, aponeurosis, bursa, synovial, sheath ; ligament, artery, vein, lymphatics, lymph node & Peripheral nerves.

Desirable to know

History of Anatomy.

LEARNING OBJECTIVES:

- Describe the basic function of living organisms.
- Identify the major levels of organization in living organism.
- Use anatomical terms to describe body sections, body regions, and relative positions.
- Identify the major body cavities and their subdivisions.

II. GENERAL EMBRYOLOGY

Must Know

Significance of Embryology, Descriptive terms, Developmental periods, Gametogenesis, Male & Female reproductive organs, Growth & rupture of ovarian follicles, Menstrual cycle, Viability of gametes.

Desirable to know

Historical gleanings.

FIRST WEEK OF DEVELOPMENT

Must Know

Fertilisation, Formation & Cleavage of Zygote, Non disjunction of chromosomes, Morula & Blastocyst, Implantation – types & abnormal sites, Formation of Decidua , Invitro-fertilisation.

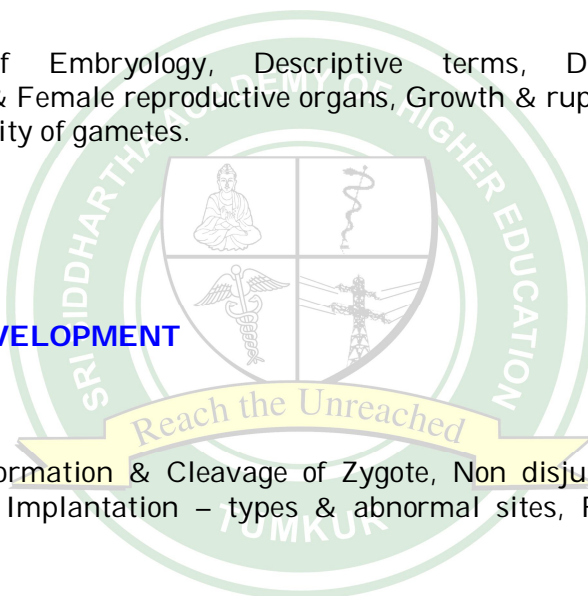
SECOND WEEK OF DEVELOPMENT

Must Know

Formation of bilaminar germ disc, Differentiation of Embryo blast & trophoblast, Development of Chorionic sac, Amniotic cavity, Extra Embryonic mesoderm & coelom.

Desirable to know

Spontaneous Abortions.



THIRD WEEK OF DEVELOPMENT

Must Know

Formation of germ layers ,early tissue & organ differentiation, appearance of primitive streak, Formation of intra-embryonic mesoderm, Formation of notochord, Development of Neural tube & neural Crest Development of somites, Vasculo genesis & Development of intra-embryonic ceolom.

Desirable to know

Hyadatiform mole choriocarcinoma.

FOURTH TO EIGHTH WEEK OF DEVELOPMENT

Must Know

Organogenesis period: Differentiation of somites, Folding of Embryo, Formation of Gut, Germ layer derivatives Appearance of pharengial arches, Upper & lower Limb buds, Estimation of gestational age.

Desirable to Know

Evaluation of ultrasound.

PLACENTA & FEOTAL MEMBRANES

Must Know

Formation of Placenta, its structure & function, Placental circulation, Placental abnormalities, Formation of Umbilical cords, its features, Amniotic cavity & membrane, Amniotic Fluid – Functions, Expansion., Chorion Decidua.

MULTIPLE PREGNANCY , FORMATION OF TWINS

Must Know

Teratology - Genetic & Environmental factors as causes for Congenital Anomalies.

Desirable to Know

Mode of actions of teratogens and critical period.

POSTNATAL GROWTH AND DEVELOPMENT

Principles of growth and development, types of postnatal growth, periods of growth, assessment of growth and development.

Desirable to know

Viability, post maturity syndrome

III. SYSTEMIC EMBRYOLOGY

Must Know

- Development of individual organs of the respiratory system, cardiovascular system, digestive system, urinary system, genital system and nervous system. Special sensory organs (in brief), endocrine glands and mammary gland.
- Developmental abnormalities.
- Development of skeletal system, muscular system (in brief).
- Development of face, bronchial apparatus and associated congenital anomalies.

IV. HISTOLOGY

Must Know

GENERAL HISTOLOGY

- Microscope
- Cell
- Epithelial Tissue I
- Epithelial Tissue II
- Connective Tissue
- Muscular Tissue
- Nerve Tissue – TS & LS of peripheral nerve, optic nerve, sensory & sympathetic ganglia
- Cartilage and Bone
- Epithelial glands (serous, mucous and mixed salivary glands).
- Circulatory system (large sized artery, medium sized artery, large sized vein).
- Lymphatic system (lymph node, thymus, tonsil and spleen).
- Skin & its appendages.
- Placenta & Umbilical cord.

SYSTEMIC HISTOLOGY

- Respiratory system – trachea & lung.
- Digestive system – Lip, tongue, esophagus, stomach, small & large intestine, Appendix, Liver, gall bladder & pancreas.
- Urinary system – kidney, ureter, urinary bladder.
- Reproductive system – female – ovary, ovarian tube and uterus.
- Reproductive system – male – testis, epididymis, vasdeferens and prostate gland.
- Hypophysis cerebri, Thyroid, Parathyroid and suprarenal.
- Eye (Cornea & Retina).
- Neuro histology – The slides to be shown for Neuro histology are given below :

- | | |
|----------------|--|
| a. Spinal Cord | - Cross section-mid thoracic level |
| b. Medulla | - C.S. at Pyramidal Decussation
C.S. at Sensory decussation.
C.S. at open part of Medulla. |

- | | |
|--------------------|---|
| c. Pons | - C.S. at lower pons.
C.S. at upper pons. |
| d. Midbrain | - C.S. inferior colliculus.
C.S. at superior colliculus. |
| e. Cerebral Cortex | - Granular cortex.
A granular cortex. |
| f. Cerebellum | - Structure of Cortex. |

V. OSTEOLOGY

Must Know

Constituents of skeleton, types of bones, classification of bones with examples, names of bones, general features of different bones, colors used for marking origin and insertion of muscles, attachment of joint capsule, aponeurosis, ligaments, fascia, reflection of synovial membrane etc., of the body & their position, development & common congenital anomalies, microscopic anatomy of bone, common sites of fractures, general pattern of blood supply, ossification of bones, applied anatomy and parts of growing long bones.

Desirable to Know

Process of the repair of bone

LEARNING OBJECTIVES

- Describe the functions of skeletal system
- Classify bones according to their shapes and give examples of each type.
- Identify the cell types found in the bone and list their major functions.
- Compare the mechanisms of intra membranous and endochondral ossification.
- Describe the blood supply of bone.
- Identify the bones of axial skeleton and specify their function.
- Identify the curvatures of the spinal column and their functional significance.
- Briefly describe how the aging process affects the skeletal system.
- Contrast the major categories of joints and explain the relationship between structure and function of each category.
- Describe the dynamic movements of the skeletal.

I. MUSCULAR SYSTEM

Must Know

Classification & identification of muscles of body, main attachments, nerve supply, action and applied anatomy.

Desirable to Know

Mechanism of movement caused by muscle / muscles & various forces exerted by them and nerve terminations

LEARNING OBJECTIVES

- Describe the characteristics and functions of muscle tissue
- Explain the unique features of skeletal muscle fiber.
- Identify the structural component of a sarcomere.
- Identify the components of neuromuscular junctions.
- Identify the structural and functional differences among skeletal, cardiac and smooth muscle cells.

VII. ARTHROLOGY

Must Know

Classification of joints, general features of different types of joints, detailed study of major joints of body & movements, a brief account of other joints. Applied anatomy of major joints. Range of movement in major joints, microscopic anatomy of articular cartilage, maintenance of articular cartilage, blood supply.

LEARNING OBJECTIVES

- a) Contrast the major categories of joints and explain the relationship between structure and function of each category.
- b) Describe the basic structure of a synovial joint; identify accessory structure and their function.
- c) List the different types of synovial joints and discuss how the characteristic motions of each type are related to its anatomical structure.

VIII. CARDIOVASCULAR SYSTEM

Must Know

Position and parts of heart, names of blood vessels & their distribution in the body, normal development of heart, common congenital anomalies, microscopic anatomy heart & blood vessels, gross anatomy of major blood vessels of the body, pericardium, pericardial cavity, concept of pericardium and applied anatomy. Parts of conducting system and developmental anomalies.

Desirable to Know

Valvular defects & their effects.

LEARNING OBJECTIVES.

- a) Describe the location and general features of the heart.
- b) Describe the structure of pericardium and explain its function.
- c) Trace the flow of blood through out the heart, identify the major blood vessels, chambers, and heart valves.

- d) Describe the vascular supply and innervations of heart.
- e) Discuss the difference between nodal cells and conducting cells, and describe the components and functions of the conducting system of the heart.
- f) Identify the electrical events associated with normal electrocardiogram.
- g) Describe the effects of hormones, drugs, temperature, and changes in ion concentration on the heart.
- h) Distinguish the types of blood vessels on the basis of their structure and function.
- i) Identify the principle blood vessels and the functional characteristics of the special circulation to brain, heart and lungs.

IX. RESPIRATORY SYSTEM

Must Know

Position parts, relations, blood supply, lymphatic drainage, microscopic anatomy, normal development & congenital anomalies of various components of respiratory tract, thoracic cage, cardiac dullness, and movements of thorax during respiration, pleura, pleural cavity, applied anatomy and superior & posterior mediastinum. Blood air barrier and cell population in the respiratory tract.

Learning objectives

- a) Describe the primary function of respiratory system.
- b) Explain how the delicate respiratory exchange surfaces are protected from pathogens, debris, and other hazards.
- c) Identify the organs of upper respiratory system and describe their function
- d) Describe the structure of larynx and discuss its role in normal breathing and sound production.
- e) Discuss the structure of extra pulmonary airways.
- f) Describe the anatomy of lungs, the structure of a pulmonary lobule, and the functional anatomy of the alveoli.
- g) Describe the origins and actions of respiratory muscles respiratory movements.
- h) Describe the physical principles governing the movement of the air into the lungs and diffusion of gases in and out of the lungs.

XI. GASTROINTESTINAL SYSTEM

Must Know

Position, parts, relations, blood supply, nerve supply, lymphatic drainage, Major salivary glands, sphincters of the gastrointestinal system. Peritoneum, peritoneal cavity, fossae & folds, applied anatomy and general description of viscera.

Desirable to know

Processing and Absorption of Nutrients, Peritonitis, Portal Hypertension.

Learning objectives.

- Identify the organs of digestive system and accessory organs of digestion.
- List the functions of digestive system.
- Describe the functional histology of digestive tract.

- Describe the process by which materials move through the GIT.
- Describe the anatomy and functions of the oral cavity, tongue and oesophagus.
- Describe the anatomy of the stomach, its histological features, and its role in digestion and absorption.
- Describe the anatomical and histological characteristics of small intestine.
- Describe the functions of intestinal secretions, and discuss the regulations of secretory activities.
- Describe the structure and functions of the liver, pancreas and gall bladder and explain how their activities are regulated and coordinated.
- Describe the structure of large intestine, its movements and its absorptive process.

XII. GENITO URINARY SYSTEM

Must Know

Parts, position, relations and blood supply, nerve supply, lymphatic drainage and applied anatomy.

LEARNING OBJECTIVES

- Describe the gross anatomy, relations, blood supply and supports of uterus.
- Describe the gross features, relations, nerve supply and applied anatomy of urinary bladder.
- Describe the gross anatomy, lobes, microscopic structure and applied anatomy of prostate.
- Describe the course, relations, microscopic picture and applied anatomy of ureter
- Describe the male urethra with applied aspects.
- Describe the ovaries and fallopian tubes in detail.

INTEGUMENTARY SYSTEM

- Must know
- Skin and its appendages, superficial fascia, deep fascia, development, microscopic and applied anatomy, Lines of cleavage and papillary ridges.
- Desirable to know
- Dermatoglyphic
- Learning objectives
- Describe the main structural features of the epidermis, and explain their functional significance.
- Explain what accounts for individual and racial differences in skin, such as color.
- Describe the effects of ultraviolet radiation on the skin and the role played by melanocytes.
- Describe the structure and function of the dermis.
- Discuss the various kinds of glands found in the skin and their secretions.
- Explain how the sweat gland play a major role in maintaining the body temperature.

XIII. ENDOCRINOLOGY

Must Know

- Endocrine glands location relations, Parts, position, blood supply, nerve supply, lymphatic drainage and applied anatomy.
- Diffuse endocrinal system.

Desirable to know

- Clinical manifestations of common endocrinal disorders.
- Learning objectives.
- Compare the endocrine and nervous system.
- Compare the cellular component of endocrine system with those of other tissues and systems.
- Compare the major chemical classes of harmonies.
- Explain the general mechanism of hormonal action and control.
- Describe the location, hormones and functions of following endocrine glands and tissues; pituitary, thyroid, parathyroid, thymus, adrenals, kidneys, heart, pancreas, testes, ovaries and pineal gland.
- Discuss the results of abnormal levels of hormonal production.

XIV. NERVOUS SYSTEM AND ITS COMPONENTS

Must Know

Parts of the nervous system, meninges, ventricles, motor and sensory pathway. Cranial nerves, functional areas, blood supply cross sectional studies and morphology of spinal cord. General features of Brain stem cerebellum and cerebrum. Autonomic nervous system including sympathetic and parasympathetic systems their ganglions and connection , Limbic system , Extra pyramidal system , correlation of microscopic anatomy with function , development al anomalies , anatomical basis of common neurological disorder / syndrome

LEARNING OBJECTIVES

- a. Sketch and label the structure of a typical neurone and describe the function of each component.
- b. Classify neurones on the basis of their structure and function.
- c. Describe the location and functions of neuroglial cells.
- d. Describe the various neurotransmitters and neuromodulators.
- e. Discuss the structure and function of the spinal cord.
- f. Discuss the three meningeal layers that surround the central nervous system.
- g. Describe the major component of spinal nerve.
- h. Name the major regions of the brain and describe their function.
- i. Name the ventricles of the brain and describe their location and connections between them
- j. Describe the formation, circulation and functions of cerebrospinal fluid.

- k. Locate the motor, sensory, and association areas of cerebral cortex and discuss their function.
- l. Describe the nuclear complex in Thalamus with functional correlation.
- m. Discuss different levels of sections of brain stem.
- n. Relate each cranial nerves to its destinations and functions.
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- o. Contrast the structure and functions of sympathetic and parasympathetic divisions of autonomic nervous system and the significance of dual innervations.
- p. Identify the receptors of general sensation and describe how they function.
- q. Identify the accessory structures of the eye and describe how they function.
- r. Describe the sensory organ of taste and trace the gustatory pathways to their destination in brain.
- s. Describe the boundaries and content of middle ear cavity.
- t. Describe the sensory organ of smell and trace the olfactory pathway to the brain's

XV. SPECIAL SENSORY ORGANS

Must Know

Gross anatomy of eyeball, ear, nose and tongue with applied anatomy.

Learning Objectives.

Describe the internal structure of the eye, and explain their function.

Explain how light stimulates production of nerve impulse, and trace the visual pathway to their destination in brain. Describe the parts of internal ear and their role in processes of maintaining equilibrium and hearing. Describe the sensory organs of taste and smell and trace the pathways to their destination in the brain.

XVI. LYMPHATIC SYSTEM

Must Know

Gross anatomy of major groups of lymph nodes and their drainage areas. Gross anatomy of lymphatics specially thoracic duct, subclavian and mediastinal lymphatics.

XVII. MEDICAL GENETICS

Must Know

Morphology of human chromosomes, amniocentesis and other methods to procure tissue/cells for the genetic study, karyogram structural and numerical anomalies of chromosome introduction to the common genetic disorders like – Mongolism, Turner syndrome, Kline filter syndrome.

Desirable to know

FISH technique.

Sections of Medulla	a) At Pyramidal decussation b) Sensory decussation c) Open part of Medulla
Pons	a) Lower pons b) Upper pons
Midbrain	a) Inferior colliculus b) Superior colliculus
Cerebellum	a) Horizontal
Cerebrum	a) Mid Saggital section b) Horizontal section at interventricular foramen c) Coronal section at anterior commissure d) Coronal section at mammillary body

Common neurological disorders:

Desirable to Know

Reticular formation, nerve terminals.

XVIII. RADIOLOGICAL ANATOMY

Identification of normal anatomical features in skiagrams, including special radiological Investigations (Barium studies, Intra Venous Urogram, Hysterosalpingography, Cholecystography, CT Scan and MRI).

XIX. SURFACE ANATOMY

Surface features of the body and projections, outline of heart, lungs, pleura, abdominal and pelvic viscera and all important blood vessels and nerves.

XX. CROSS SECTIONAL ANATOMY

Cross sections of head and neck, thorax, abdomen and pelvis at different levels to understand the interrelations of organs at the following levels:

THORAX	-	T-3, T-4, T-5 Levels	-	Horizontal section
ABDOMEN	-	L-1, L-2, L-4 Levels	-	Horizontal section
Pelvis	-	Saggital section of male & female.		
Head & Neck	-	Mid saggital section & horizontal sections at C4 & C6.		
Brain	-	Already mentioned	-	In Neuro Anatomy

PRACTICALS (32 – 35 wks)

GROSS ANATOMY

Upper Limb	Dissection	Pectoral, scapular and shoulder region, arm, forearm (5 wks) Prosected parts : Joints, Palm and dorsum of hand.
Lower Limb	Dissection	Gluteal region, front, medial and back of thigh, popliteal fossa leg and dorsum of foot. (4 wks) Prosected Parts: Sole of the foot and joints.
Thorax	Dissection	Chest wall, mediastenum, lungs, and heart. Cross sectionist T-3, T-4 and T-5 Levels (3 wks)
Abdomen	Dissection	Anterior abdominal wall and inguinal region. Viscera and posterior Abdominal wall– cross sections at L-1, L-2 and L-4 levels (4 wks).
Pelvis	Dissection	Pelvic viscera, blood vessels and nerves – sagittal section of male& female (2 wks) Prosection Parts : Perinium including ischio –rectal fossa
Head & Neck & Brain	Dissection	Scalp, Superficial and deep dissection of face and neck. (8 wks to 10 wks). Prosected Parts: Orbit, eyeball, submandibular region, naso and Temporal and infratemporal fossa, cranial cavity, oropharyngeal regions, Ear, larynx and pharynx. Cross sections at C-4 and C-6 levels. Sagittal section of Head & Neck. Meninges, Brain stem & cerebellum, Cerebral Hemisphere, functional area, Blood supply, Thalamus & hypothalamus, lateral ventricle & deep structures of cerebral hemisphere (2 wks).

DEMONSTRATION

- Bones as described in osteology section.
- Brain and spinal cord.
- Cross – sectional anatomy.
- Radiological anatomy.
- CT and MRI.

MICROSCOPIC ANATOMY

Stained slides of all the tissues and organs.

DEVELOPMENTAL ANATOMY

Models to demonstrate various stages of fertilization, implantation, formation of embryo, development of fetus and various organs & systems. Commonly encountered congenital defects.

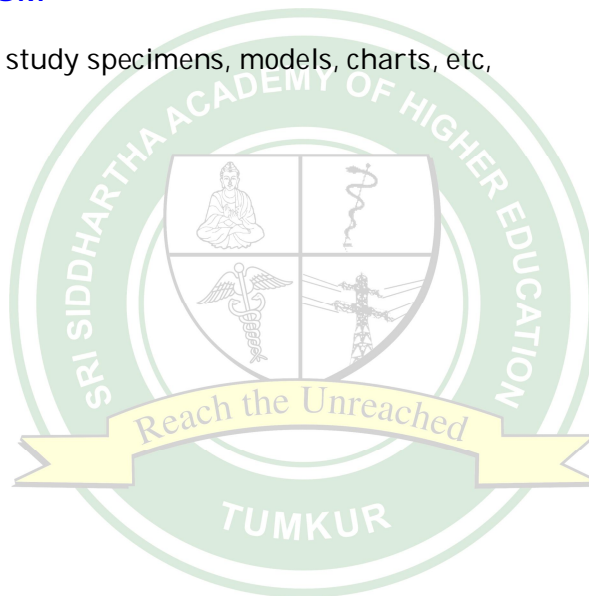
GENETICS

Demonstration of:

- Karyotyping, Normal XX and Normal XY, Mitosis & Meiosis.
- Karyotype and clinical features of Downs , Klinefelter's and Turners Syndrome , Buccal Smear & different bandings photographs. Pedigree of case given,

VISIT TO THE MUSEUM

At least once a week to study specimens, models, charts, etc,



PHYSIOLOGY

Course Contents

General physiology

Must Know

- Principles of homeostasis
- Structure of cell membrane
- Transport mechanisms , RMP
- Intercellular communications
- Fluid compartments of the body
- Cell and cell organelles
- **Desirable to know**
- Apoptosis and aging
- Genetics overview

Blood

Must Know

- Composition and functions of blood
- RBC – formation, function and anemia's
- WBC- formation, function and Leukemia's
- Hemoglobin – synthesis and functions
- Hemoglobinopathies
- Platelets & Plasma Proteins
- Blood groups - basis of blood grouping, clinical importance, blood banking and transfusion
- Haemostasis, anticoagulants
- Immunity
- Autoimmune disorders

Desirable to know

- Jaundice

Digestive system

Must know

- Basic structure of Digestive system
- Functions of – Salivary secretion, gastric secretion, pancreatic secretion , intestinal secretion, bile, gastro-intestinal hormones – source, regulation and functions, gastro- intestinal movements, liver and bile.

Desirable to know

- Pathophysiology of peptic ulcer, gastro oesophageal reflux disease, vomiting, diarrhoea, constipation,

Endocrinology

Must know

- Gen endocrinology, mechanism of action of hormones
- Regulation of various important hormones
- Physiological actions and effect of altered secretion of pituitary gland, thyroid gland, parathyroid gland
- Adrenal gland, pancreas and hypothalamus, growth hormone
- Pineal gland and local hormones

Desirable to know

- Estimation and assessment of hormones

Cardiovascular system

Must know

- Properties of cardiac muscle
- Conducting system of heart
- Cardiac cycle & Heart sounds
- Cardiac output & Measurement. Regulation
- Hemodynamics of circulatory system
- Regulation of heart rate and blood pressure
- Electrocardiogram-physiological basis and applications.
- Regional circulation-coronary, cerebral, capillary, foetal and pulmonary circulation, muscle, skin and splanchnic
- Abnormal ECG

Desirable to know

- Pathophysiology of shock, coronary artery disease, hypertension and heart failure.
- Cardio-pulmonary resuscitation

- Respiratory system

Must know

- Functional anatomy, Non respiratory functions of lung
- Mechanics of normal respiration
- Pressure changes during Respiratory cycle

- Regulation of respiration
- Transport of respiratory gases, Gas exchange
- Lung function test-clinical significance
- Principles of artificial respiration, oxygen therapy, acclimatization to high altitude and decompression sickness.
- Pathophysiology – hypoxia, cyanosis and asphyxia.

• Special senses

Must know

- Functional anatomy of eye
- Physiology of image formation, colour vision, refractive errors Visual reflexes- pupillary and light reflex
- Effect of lesion for visual pathway
- Functional anatomy ear
- Mechanism of hearing
- Pathophysiology of deafness
- Perception of smell and taste sensation
- Pathophysiology of altered smell and taste sensation
- Tuning fork test and interpretations

• Special senses

Desirable to know

- Nutritional deficiency and blindness
- Pathophysiology of blindness
- Auditory & visual evoke potential
- Audiometry
- Skin and body temperature regulation
- Mechanism of temperature regulation
- Adaptation to Extreme temperature (heat and cold)
- Mechanism of fever, cold injuries and heat stroke.
 - Physiology of growth
 - Regulation of body pH

Desirable to know

- Physiology of sports, exercise, yoga and meditation,
 - Cardio-respiratory and metabolic adjustments
 - Physiological effects of yoga and meditation
- Renal system

Must know

- Structure and function of nephron
- Renal circulation and kidney function
- urine formation involving processes of filtration, tubular absorption, secretion and concentration
- water diuresis and osmotic diuresis
- concentration of urine
- Structure and function of a Juxta glomerular apparatus
- Role of renin- angiotensin system
- Fluid and electrolyte balance and its regulation
- Innervations of bladder, micturition, abnormalities of micturition
- Renal Function Tests

Desirable to know

- Artificial kidney, dialysis and renal transplantation
- Diuretics

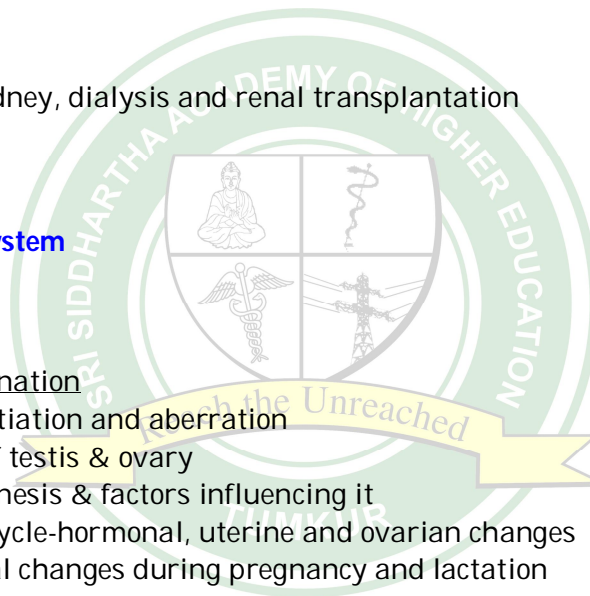
• Reproductive system

Must know

- Sex determination
- Sex differentiation and aberration
- Functions of testis & ovary
- Spermatogenesis & factors influencing it
- Menstrual cycle-hormonal, uterine and ovarian changes
- Physiological changes during pregnancy and lactation
- Puberty
- Physiological effect of sex hormones
- Pregnancy, Foeto placental unit, pregnancy tests
- Menopause
- Contraceptive methods (male and female methods)
- Fetal physiology

Desirable to know

- Infertility



Central nervous system

Must know

- Organization of nervous system
- Functions and properties of synapse, reflex, receptors.
- Structure and function of spinal cord and its injuries
- Functions of cortex, sensory and motor pathways, basal ganglia, thalamus, hypothalamus, cerebellum and limbic system.
- Structure and function of reticular activating system, autonomic nervous system
- Mechanism of maintenance of tone, posture and equilibrium-vestibular apparatus
- Higher functions (Memory, Learning, Speech)
- Pathophysiology of Parkinsonism, section of spinal cord.
- EEG and Sleep
- Pain and referred pain
- Regional circulation and CSF
- Neurotransmitter in CNS

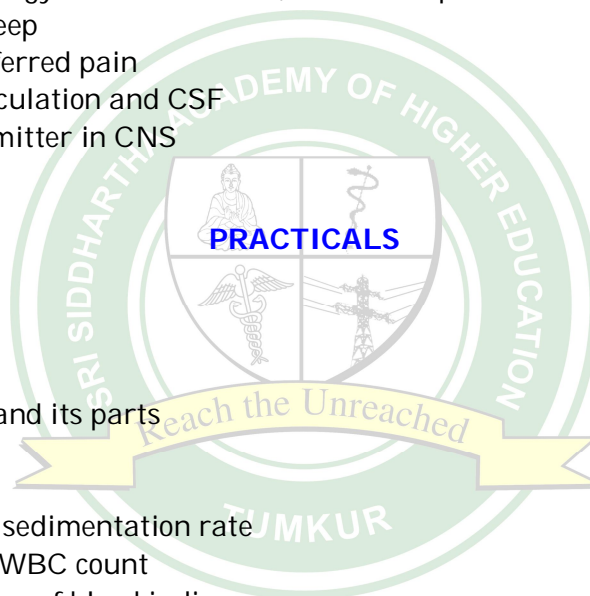
Haematology

Must know

- Microscopy and its parts
- RBC count
- WBC count
- Erythrocyte sedimentation rate
- Differential WBC count
- Determination of blood indices
- Hb estimation (MOV. MCV+, MCHC)
- Absolute eosinophil count
- Bleeding time
- Clotting time
- Blood grouping

Desirable to know

- Cross matching
- Haematocrit
- Reticulocyte count
- Platelet count
- Osmotic fragility



Must know

- Properties of nerve and muscle to be demonstrated by computer boxed modules
- Mosso's ergograph – At normal condition, after venous occlusion and arterial occlusion
- Electromyography Desirable to know
 - Respiratory system (Must know)
- Perform spirometry (computer Spirometer if available) and interpret recording to appreciate restrictive and obstructive airway disease.
- Stethography
- PEF by weight's mini peak flow meter

Examination of respiratory system

- Locate the position of trachea and appreciate its deviation in disease
- Percuss lung fields to appreciate change is note in disease.
- Ascultate lung fields
- Appreciate normal breath sound and pickup audition sounds.
- Cardiopulmonary resuscitation Desirable to know

CARDIOVASCULAR SYSTEM

Must know

History taking

- Examination peripheral arterial pulse
- Record arterial blood pressure using sphygmomanometer, posture exercise.
- Examination of cardiovascular system
- Locate the apex heart
- Ascultate the areas of heart appreciate heart sound, pick up abnormal sounds.
- Echocardiography (Desirable to know)
- Record ECG, Identify normal waves, intervals and pickup abnormalities.

Nervous system

Must know

Examination of sensory system (touch, pain, pressure and temperature)

Examination of motor system (Nutrition, Power and Coordination)

Examination of superficial and deep reflexes

Examination of cranial nerves (sensory and motor division)

Desirable to know

Examination of autonomic nervous system.

ECG, EMG and nerve conduction studies

Special senses

Must know

Acuity of vision (near and distant vision)
Colour vision
Field of vision by perimetry
Tests for hearing
Test for smell and taste
Desirable to know
Principle of ophthalmoscope
Optometry
Audiometer
Must know
Interpretation of charts Problems and case histories

