



B L D E UNIVERSITY

Ordinance Governing MBBS Degree Course

(REVISED CURRICULUM-2016)

Phase-I

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B L D E University

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The Constituent College

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Index

Introduction

SECTION - I

Objectives of Medical Education
(As stated in MCI Regulations, 1997)

SECTION - II

Regulations Governing MBBS Degree Course
(Eligibility for Admission, Duration, Attendance and Scheme of Examination)

HUMAN ANATOMY

PHYSIOLOGY

BIOCHEMISTRY

INTRODUCTION TO HUMANITIES
AND COMMUNITY MEDICINE

MEDICAL ETHICS

ANNEXURES

Phase I

Introduction

The revised M.B.B.S curriculum of The Medical Council of India (MCI) came into effect from May 1997 and it has undergone amendments thereof. The BLDE University has implemented the new regulations for the batches of students admitted to the M.B.B.S course from the academic year 2008-09 and onwards. Later the curriculum was revised in 2012-13. This third revision will be implemented for the batches of students admitted to the M.B.B.S Course from the academic year 2016-17 onwards.

These regulations recommend the following:

- 1) That every medical college should have curriculum committee which would plan curricula and instructional method which would be updated regularly.
- 2) That every medical college establishes a medical education unit for faculty development, preparation of learning resource materials and improved evaluation methods.
- 3) 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.
- 4) That the medical curriculum should be oriented towards educating students to take up the responsibilities of physicians of first contact. The medical graduate should be capable of functioning independently in both urban and rural environment of our country and internationally.
- 5) That educational experience should emphasise health rather than only disease, and community orientation also instead of only hospital orientation. Population control, national health programs and family planning should also be given due emphasis. The thrust should be on common diseases rather than rare disorders.
- 6) Every effort should be made to provide educational experience that allows hands-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.

- 7) That there should be Shift in the role of medical teachers from mere imparting knowledge to that of a facilitator and motivator of student learning.
- 8) 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.
- 9) Integration of ICT in teaching learning process is required and should be implemented.
- 10) 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
- 11) That maximum effort should be made to encourage integrated teaching and every attempt be made to de-emphasise compartmentalization of disciplines so as to achieve horizontal and vertical integration in different phases. This can be planned by encouraging integrated teaching between traditional subject areas using a problem based learning approach starting with clinical or community cases and exploring the relevance of various preclinical disciplines in both understanding and resolution of the problem.
- 12) Areas which need to be addressed with due importance are:
 - Maternal and child health
 - Sanitation and water supply
 - Immunization and revised guidelines
 - Health education
 - IHPS standard of health at various levels
 - Biomedical waste disposal
 - Orientation to Organizational and Institutional arrangements in health care delivery
 - Training in documentation skills and research
 - History of modern medicine
 - Awareness regarding ethical issues and problems, analysis and competency in dealing in an acceptable manner [Medical ethics teaching should be planned at all levels with dedicated time allotment. It should be taught in all phases with appropriate clinical relevance].

- 13) 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.
- 14) Regular periodic assessment to 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 skill or participation in projects and assignments (even) during vacation. These be evaluated objectively and recorded.
- 15) Examinations 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

BLDE University endorses these recommendations and strongly desires to implement them while conducting the MBBS course

SECTION - I

Objectives of Medical Education

(As stated in MCI Regulations, 1997 amended up to Feb 2012)

This section contains the goals and general objectives of graduate medical education as stated in MCI Regulations, 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 programme, the medical student should be able to:

- (a) Recognize 'health for all' as a national goal and health right of all citizens and by undergoing training for medical profession fulfill his/her social obligations towards 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 promotive, preventive, curative and rehabilitative aspects of common diseases.
- (d) Develop scientific temper, acquire educational experience for proficiency in profession and **promote healthy 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 undergraduate students coming out of a medical institution should:

- (a) Be competent in diagnosis and management of common health problems of individual and the 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 administrations of the “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 area of medicine, action research and documentation skills.
- (f) Be familiar with the basic factors which are essential for the implementation of the National Health Programs including practical aspects of the following:-
 - i) Family Welfare and Maternal and Child Health (MCH)
 - ii) Sanitation and water supply,
 - iii) Prevention and control of communicable and non-communicable diseases,
 - iv) Immunization,
 - v) Health Education;
 - vi) IPHS standard of health at various levels of service delivery and medical waste disposal.
 - vii) Organizational institutional arrangements
 - viii) Basic management skills in managing various aspects of health care delivery, inventory skills
- (g) Acquire basic management skill in the area of human resources, materials and resource management related to health care delivery, general and hospital management, principal inventory skills and counseling.
- (h) 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.
- (i) Be able to work as a leading partner in health care teams and acquire proficiency in communication skills& work in a variety of health care settings.
- (j) 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.

(k) All efforts must be made to equip the medical graduate to acquire the detailed skills as mentioned in the Appendix B of Medical Council of India Regulations on Medical Education, 1997.

[Source: GME Regulations amended up to February 2012]

SECTION - II

REGULATIONS GOVERNING M.B.B.S. DEGREE COURSE

(Eligibility for Admission, Duration, Attendance and Scheme of Examination as per the norms laid down in the Regulations on Graduate Medical Education of Medical Council of India and the amendments thereof (till July 2016); admission to UG course - MBBS)

1. ELIGIBILITY

1.1 **Qualifying Examination**

Student seeking admission to first MBBS course:

- i) shall have passed two year Pre University examination conducted by Department of Pre University Education, Karnataka State, with English as one of the subjects and Physics, Chemistry and Biology as optional subjects. The candidate shall have passed subjects of English, Physics, Chemistry and Biology individually.

OR

- ii) shall have passed any other examination conducted by Boards / Councils / Intermediate examination established by State Governments / Central Government and recognized as equivalent to two year Pre University examination by the BLDE University / Association of Indian Universities (AIU), with English as one of the subjects and Physics, Chemistry and Biology as optional subjects and the candidate shall have passed subjects of English, Physics, Chemistry and Biology individually.

OR

- iii) shall have passed Intermediate examination in Science of an Indian University / Board / council or other recognized examining bodies with Physics, Chemistry and Biology, which shall include a practical test in these subjects and also English as compulsory subject. The candidate shall have passed subjects of English, Physics, Chemistry and Biology individually.

OR

- iv) shall have passed first year of the three year degree course of a recognized University with Physics, Chemistry and Biology including a practical test in these subjects provided the examination is an 'University Examination' provided that the candidate shall have passed subjects of English, Physics, Chemistry and Biology individually in the Pre University or other examinations mentioned in the clauses above.

OR

- v) shall have passed B.Sc. Examination of an Indian University, provided that he/she has passed the B.Sc. examination with not less than two of the following subjects: Physics, Chemistry, Biology (Botany, Zoology) provided that candidate has passed subjects of English, Physics, Chemistry and Biology individually in the qualifying examinations mentioned in clauses (i) (ii) and (iii).

Note: Candidates who have passed "Physical Science" instead of Physics and Chemistry as two separate subjects are not eligible for admission to MBBS course as per Medical Council of India Regulations vide letter MCI-37(2)/2001/Med.922 dated 14.02.2001

1.2 Marks

The selection of students shall be based on merit provided that:

- a) In case of admission on the basis of qualifying examination, a candidate for admission to MBBS course must have passed individually in the subjects of Physics, Chemistry, Biology and English and must have obtained not less than 50% marks for general category, 40% for SC, ST and OBC students taken together in Physics, Chemistry and Biology in the qualifying examination.

The minimum marks shall not be less than 45% taken together in Physics, Chemistry and Biology for physically handicapped candidates with lower limb locomotor disability of 40 to 70%.

- b) The student shall appear for All India National Eligibility cum Entrance Test [NEET] and must qualify securing valid rank.

- 1.3 **Age:** The candidate should have completed 17 years of age on or before 31st day of December of the year of admission.

DURATION OF THE COURSE

- i) Every student shall undergo a period of certified study extending over 4¹/₂ Academic years from the date of commencement of this study for the subject comprising the medical curriculum to the date of completion of the examination followed by one year compulsory rotating Internship.

The 4¹/₂ years course has been divided into three Phases.

1. **Phase – I** – 1 year, consisting of two terms of 6 months each.
 2. **Phase – II** - 1¹/₂ years, consisting of three terms of 6 months each
 3. **Phase – III** - 2 years, consisting of 4 terms of 6 months each.
- ii) The first year shall be occupied in the study of the Phase - I (Pre Clinical) subject of Human Anatomy (650 hours), Physiology including Bio Physics (480 hours), Bio Chemistry (240 hours) and Introduction to Community Medicine (60 hours). A detailed syllabus is given in later Section.
- iii) After passing pre-clinical subjects in Phase – I, the Phase – II shall be 3 terms (1¹/₂ years), devoted to Para clinical and Clinical subjects. Para Clinical subjects shall consist of Pathology, Pharmacology, Microbiology, Forensic Medicine including Toxicology and part of Community Medicine. During this phase the clinical subjects shall be taught concurrently. The clinical subjects taught will be Medicine and its allied specialties, Surgery and its allied specialties and Obstetrics and Gynecology.
- iv) Phase – III Part-I consists of Community Medicine, ENT and Ophthalmology.
- v) Phase – III Part-II consists of Medicine & allied specialties, Pediatrics, Surgery and allied specialties, Obstetrics and Gynecology.

ACADEMIC TERMS

All candidates admitted beyond the last date stipulated by the University shall have to appear for I Professional Examination to be held subsequent to the regular examination after completion of the prescribed duration.

ATTENDANCE

Every candidate should have attendance not less than 75 % of the total classes conducted in theory, practical and clinical jointly 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 III, Section 4, Extraordinary issued on 15th October 2003)

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

The candidate lacking in the prescribed attendance and progress in any subject(s) in theory or practical/clinical in the first appearance should not be permitted to appear for the examination in that subject(s).

Teaching Hours and Hospital Postings

Number of teaching hours allotted for various subjects are as under:

Table 1:- Theory Lectures, Demonstrations and Seminars etc.

Method	Subject/Number of Hours			
	Anatomy	Physiology	Biochemistry	Community Medicine
Lectures	4 hrs per week	160 hrs	120 hrs	40 hrs
Tutorials	1 hr per week	80 hrs	20 hrs	10 hrs
Group Discussion*	1 hrs per week		20 hrs	4hrs
Practical/Demonstration**	2 hrs per week	240 hrs	80 hrs	6 hrs
Dissection	8 hrs per week	---	---	---
Total	650	480	240	60

* Includes Seminars, Integrated Teaching

** Includes field visits

Scheme of Examination

Internal Assessment

It shall be based on evaluation of assignment, presentation of seminar, clinical a Clinical presentation etc., (see Annex — I for examples).

Regular periodic examinations should be conducted throughout the course. Although the question of number of examinations left to the institution, there should be a minimum of at least three (3) sessional examinations during the course. One of these tests can be in the form of MCQS. One of the practical/clinical examination can be in the form of OSPE/OSCE. Average of best two examination marks should be taken into consideration while calculating the marks of the internal assessment. Day-to-day records should be given importance in the internal assessment.

Proper record of the work should be maintained, which will be the basis of internal assessment of all students and should be available for scrutiny.

Weightage for internal assessment shall be 20% of total marks in 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 Part III, Section 4. Extraordinary issued on 15th October 2003.*)

Assistant Professor and above or Lecturer with five years of teaching experience can conduct internal assessment examination.

Theory

Minimum of three examinations is recommended. The examination preceding the University examination may be similar to the University examination. The marks allotted for internal assessment for different subjects is shown in Table 3 and 4. Average marks

of best of two notified internal examinations should be reduced to the marks allotted for internal assessment for each subject and should be sent to the University.

Phase I

Internal Assessment for Anatomy & Physiology

Total Marks: 80 (Theory – 60 and Practical – 20) - for each subject

Theory

For theory internal assessment, Minimum of three examinations is recommended. The sessional examination preceding the University examination may be similar to the pattern of University examination. Average of any two best marks obtained in the notified internal examinations may be taken into consideration for calculating internal assessment. The total marks be reduced to 60 and sent to the University.

Practicals

For practical internal assessment there will be two terminal examinations. Five marks will be for records and 15 marks for terminal examinations. Average marks of the two terminal examinations shall be reduced to 15 marks and added to the marks obtained for records and sum of the two shall be sent to the University.

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

Internal Assessment for Biochemistry

Total Marks: 40 (Theory: 30 and Practical: 10)

Theory and Records

Minimum of three examinations are recommended. The examination preceding the University examination will be similar to the University examination. The total marks would be

30. Average marks secured out of best of two notified internal examinations should be reduced to 30. The sum of the marks obtained in theory and records shall be sent to the University.

Practical / Clinical

A minimum of two practical tests is to be conducted, one at the end of each term. Average of the two tests should be reduced to 10 marks and shall be sent to the University. Out of this 10 marks for practicals, 3 marks can be allotted to records.

Assistant Professor and above or Lecturer with five years of teaching experience can conduct internal assessment examination. The internal assessment marks of both theory and practical obtained by the candidates should be sent to the University at least fifteen days prior to the commencement of theory examination.

University Examination - Subjects and Marks

		Anatomy	Physiology	Biochemistry
A. THEORY				
1. Written Paper No. of Papers & Maximum Marks for each Paper		Two 2 X 100 = 200	Two 2 X 100 = 200	Two 2 X 50 = 100
2. Viva-Voce		40	40	20
3. Internal Assessment (Theory)		60	60	30
Total (Theory)		300	300	150
B. PRACTICAL				
1. Practicals		80	80	40
2. Internal Assessment (Practical)		20	20	10
Total Practicals		100	100	50
GRAND TOTAL		400	400	200

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

Type of Questions	Number of questions	Marks for each question	Total marks
Essay type questions	2	10	20
Short Essay types questions	10	5	50
Short answer questions	10	3	30
			100

8. SUBMISSION OF LABORATORY RECORD NOTE BOOK

Each candidate shall submit to the Examiners his/her laboratory notebook duly certified by the Head of the Department as a bonafide record of the work done by the candidate at the time of Practical/Clinical Examination.

The candidate may be permitted by the examiners to refer the practical record Book during the Practical Examination in the subject of Biochemistry only. No other material, handwritten, cyclostyled or printed guides are allowed for reference during the practical examination.

9. ELIGIBILITY FOR EXAMINATION:

To be eligible to appear for University examination a candidate:

- a. Shall have undergone satisfactory the approved course of study in the Subject/subjects for the prescribed duration.
- b. Shall have attended at least 75% of the total number of classes in theory and practical/clinical, jointly to become eligible to appear for examination in that subject/subjects.
- c. Shall 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.
- d. Shall fulfill any other requirement that may be prescribed by the University from time to time.

- e. Who fails in any subject/subjects of MBBS Phase -1, has to put one academic term before he/she becomes eligible to appear for the next examination
- f. Shall pass in all the Phase I (Pre-Clinical) subjects, before joining the Phase II (Para Clinical) subjects.

Criteria for Pass

For declaration of pass at the University examination, a candidate shall pass both in Theory and Practical/Clinical Examinations separately in the same examination, and as stipulated below: A candidate must obtain 50% marks in aggregate with a minimum of 50% marks in Theory including viva-voce and minimum of 50% marks in Practical / Clinical, in each of the subjects.

A student has to secure marks as follows to pass in a subject:

- i) 35% in internal assessment (for eligibility to appear for University examination)*
- ii) 50% of the total marks for Theory with Orals (only externals)*
- iii) 50% of the marks of Practical / Clinical (only externals)*
- iv) 50% of the aggregate (total of externals and internals)*

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.

10. DECLARATION OF CLASS:

- a) A candidate having appeared in all the 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.
- b) A candidate having appeared in all the 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.
- c) A candidate having appeared in all the 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.

- d) 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.

[Please note fraction of marks should not be rounded off for clauses (a), (b) and (c)]

11. MIGRATION

- a) Migration from one medical college another is not a right of a student. However, migration of students from one medical college to another medical college in India may be considered by Medical Council of India, only in exceptional cases on extreme compassionate grounds, provided following criteria are fulfilled. Routine migrations on other grounds shall not be allowed.
- b) Both the colleges, i.e., one at which the student is studying at present and one to which migration is sought, should have been recognized by the Medical Council of India.
- c) The applicant candidate should have passed first professional MBBS examination.
- d) The applicant candidate should submit his/her application for migration complete in all respects, to all authorities concerned within a period of one month of passing (declaration of results) the first professional Bachelor of Medicine and Bachelor of Surgery (MBBS) examination.
- e) The applicant candidate must submit an affidavit stating that he/she will pursue 18 months of prescribed study before appearing for II professional MBBS examination at the transferee medical college, which should be duly certified by the Registrar of the concerned University in which he/she is seeking transfer. The transfer will be applicable only after receipt of the affidavit.

NOTE I:

- i. Migration during clinical course of study shall not be allowed on any ground.
- ii. All applications for migration shall be referred to Medical Council of India by college authorities. No Institution/University shall allow migration directly without the approval of the Council.

- iii. Council reserves the right, not to entertain any application which is not under the prescribed compassionate grounds and also to take independent decision where applicant has been allowed to migrate without referring the same to the Council.

NOTE II: * Compassionate grounds criteria:

- i. Death of a supporting parent or guardian
- ii. Illness of the candidate causing disability
- iii. Disturbed conditions as declared by Government in the Medical College area.

12. ELIGIBILITY TO JOIN PHASE II OF THE COURSE

Only candidates who pass in all the Phase I (Pre Clinical) subjects shall be eligible to join the Phase II of the course.

Section - III

Course contents for MBBS Phase I

Human Anatomy

Goal:

Aims at conveying comprehensive knowledge of the gross and microscopic structure and Development of human body to provide anatomical basis for diseases and clinical conditions.

Objectives:

A. Knowledge:

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

- a) Understand the normal disposition, functional and cross sectional anatomy of various structures of the body and its clinical relevance
- b) Identify the microscopic structure of various organs and tissue and comprehend their functions in order to understand the alterations in various disease processes
- c) Comprehend functional organizations of central nervous system and interpret various signs and Symptoms presented as neurological deficit so that he/she may confidently make a diagnosis.
- d) Demonstrate basic concepts of development of organs and tissues, explain the effect of teratogens, environmental factors and genetic mutations on critical stages of development

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 CT scan. Sonogram USG 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, student shall be able to correlate the structure and functions of the body in order to provide anatomical basis for various disease process.

List of Topics for Integrated Teaching Programme

During MBBS Phase – I Course

Sl.No.	Topics	Department to organize	Departments to participate
1	Human Genetics: Anatomical considerations(Anat), applied aspects (OBG & Paed.)	Anatomy	Anatomy, OBG & Pediatrics.
2	Acid Peptic disease: Anatomy of stomach(Anat), Functional aspects of stomach (Phy), Pathophysiology of Acid Peptic disease (Path), Medical Management of acid peptic disease (Med), Surgical Management of acid peptic disease (Surg)	Anatomy	Anatomy, Physiology, Pathology, Medicine & Surgery.
3	Liver: Structure of Liver (Anat), functional aspect of liver (Phys), Biochemical aspect of liver (Bioch)	Anatomy	Anatomy, Physiology, Biochemistry.
4	Parkinsonism: Anatomy of Basal Ganglia (anat), Physiology of BG (Phys), clinical features, investigations & treatment (Med)	Anatomy	Anatomy, Physiology, Medicine.
5	Uterus: Anatomy of Uterus(Ana),Physiological changes(Phy),Applied aspects(OBG)	Anatomy	Anatomy, Physiology, OBG
6	Inguinal Hernia: Anatomy of Inguinal canal , Hernia (Ana),Surgical aspects & Management (Sur)	Anatomy	Anatomy, Surgery
7	Thyroid Gland: Anatomy of Thyroid Gland (Ana),Synthesis of thyroid Hormones (Phy.) ,Medical Management of Thyroid disorders(Med),Surgical Management of Thyroid disorders (Sur)	Anatomy	Anatomy, Physiology, Medicine ,Surgery
8	Shoulder Joint. - Anatomy of Shoulder joint.(Ana) Radiological features (Radio.) Applied Aspects and management (ortho)	Anatomy	Anatomy, Radiology, Orthopedics. Physiotherapy
9	Knee Joint - Anatomy of Knee joint.(Ana) Radiological features (Radio.) Applied Aspects and management (ortho)	Anatomy	Anatomy, Orthopedics, Physiotherapy & Radiology,
10	Blood Supply to Heart – Anatomy of Coronary Arteries, Physiology of Blood supply, Medical Management	Anatomy	Anatomy, Physiology, Medicine,
11	Congenital Anomalies of Heart – Development of	Anatomy	Anatomy, Pediatrics.

	Heart,(Ana) Applied Aspect (Paed.)		
12	Lungs – Bronchopulmonary segments Anatomy of BPS(Ana) Physiological Aspects of Respiration (Phy) Medical Management (Med)	Anatomy	Anatomy, Physiology, Medicine,
13	Mediastinum – Anatomy of mediastinum (Ana) Applied Aspects and management (Med.)	Anatomy	Anatomy, Medicine

5) One of the formative practical examination to be conducted in the form of OSPE/OSCE (partially or totally)

(iii) Detail syllabus of Human Anatomy is given under following headings:

A) General Anatomy

B) Regional Anatomy

- I. - Upper limb
- II. - Lower Limb
- III. - Abdomen
- IV. - Thorax
- V. - Head Face Neck
- VI. - Spinal Cord & Brain

C) Micro-Anatomy

- I. - General Histology
- II. - Systemic Histology

D) Developmental Anatomy

- I. - General Embryology
- II. - Systemic Embryology

E) Genetics

F) Radiological Anatomy, USG, CT, MRI

G) Surface Anatomy, Living & Marking

H) University Exam pattern, Theory & Practical

Books recommended

A) GENERAL ANATOMY

I) DESCRIPTIVE TERMS

Terms used for describing the position of the body, Anatomical planes, Commonly used terms in Gross Anatomy, Terms used in Embryology, Terms related to limbs, for hollow organs, for solid organs, to indicate the side, for describing muscle, for describing movements.

II) General Osteology:

Definition, Nutrition and Morphological Classification, Distribution and Functions of bone, Appendicular, Axial.

Diaphysis, Metaphysis, Epiphysis, Types of epiphysis

Primary centres, Secondary centers, Law of ossification, Epiphy seal plate, Blood supply of long bone.

CARTILAGE

Definition, Types structure, Distribution, Nutrition

III) General Arthrology

Classification, Synarthrosis, Amphiarthrosis, Diarthrosis joints

Cartilaginous joints Primary, Secondary

Synovial- Axis of movement, Structure of typical synovial joints

Classification of synovial joints, according to the shape axes of movement and morphology.

Simple, Compound, Complex joints, Blood supply and nerve supply.

IV) General Mycology

Definition, Types: Origin, Insertion, Morphological classification

Actions of muscles, nerve supply

Functional classification, Prime movers, Fixators, Antagonists, Synergists

BURSA, Structure, Functions, types:

LIGAMENTS, Types and functions, Sprains

RETINACULA AND APONEUROSES

V) INTEGUMENT

a) Skin – Introduction: Surface area

Types: Thin, Thick, hairy, Functions, innervations

Structure:

Epidermis, Dermis, Appendages

b) SUPERFICIAL FASCIA

Distribution of fat, functions

c) DEEP FASCIA

Features, Modifications, Functions

VI) General Angiology

Arteries: Muscular, Elastic; Arterioles: Capillaries: Sinusoids, Veins – Anastomosis: End arterial: Vasa Vasorum, Nerve supply of blood vessels.

Lymphatic system

Lymph vessels, Central lymphoid tissue, Peripheral lymphoid organs, Circulating lymphocytes – T and B lymphocytes.

VII) General Neurology

Structure of nervous tissue

Neurons: Synapses: Structural- type, Functional types

Classification of neurons: According to polarity and According to relative lengths of Axons and dendrites:

Neuraglia: Nerves: Cranial- Spinal, Structure of typical spinal nerve

Autonomic nervous system: Sympathetic: Sympathetic ganglia, postganglionic fibres

Parasympathetic: Cranial outflow, sacral outflow.

Desirable to know - Mechanical properties of bones.

Synthesis, histogenesis, growth of Cartilage, Factors limiting range of movement.

Kinesiologically: Sellar, Ovoid, Joint position:: Loose-packed, Close-packed

Number and diameter of fibres, Range of contraction. Active insufficiency, Passive insufficiency, shunts. Swing, spin

Adventitious bursae- Housemaid's knee, Clergyman's knee, Student's elbow, Weaver's bottom, Porter's shoulder

Clinical correlation, significance of Langer's lines, Tension lines, flexure lines

Transplant

Collateral circulation, Functional end arteries. Arteriosclerosis.

Nice to know: Effect of hormones on bony growth. Wolff's law, Surface topology of articular surface. Spin, Swing, Cartilage Grafts, Kinesiology, Body lever system, Skin grafts. Ischemia, Infarct, Bursitis.

B) Regional Anatomy

I. UPPER LIMB

REGIONS: Mammary gland. Axilla, Cubital fossa, Facial spaces of the hand

Relations and functional importance of individual structures, Dupuytren's

Contracture: Hand as a functional unit – grips, Nerve injury, carpal tunnel syndrome, Clavipectoral fascia: Salient features about carpals;

ARTHROLOGY

Shoulder girdle: Shoulder joint: Elbow; Radioulnar joints; Wrist; Carp metacarpal joint of Thumb; Bones taking part.

Classification of joints, Movement with muscles causing movement, midcarpal joint, Metacarpophalangeal joints, interphalangeal joints.

Fall on the outstretched hand

Desirable to know- Axilla: Collaterals Lymph nodes (breast) Axillary sheath cervico axillary

Canal, Abscess drainage, Palm: comparative Anatomy (thumb, Palmaris brevis),

Position of rest and of function, collaterals,

Facial spaces: Surgical significance

OSTEOLOGY

Identification: Anatomical position, Parts; Joints formed; Development; identification

Clavicle: Line of force transmission, commonest site of fracture

Humerus: fractures-

Colles' fracture Smith's fracture

Carpals, Metacarpals, Phalanges: Carpal tunnel syndrome, fracture scaphoid surgical

Approaches, Subluxation of head of radius carrying angle.

MYOLOGY:

Muscles of upper limb, attachment, Nerve supply, Actions

Applied aspects: Volkmann's ischemic contracture

Quadrangular and Triangular spaces, Triangle of auscultation.

ANGIOLOGY:

Axillary, Brachial, Radial, Ulnar Arteries, Veins, Lymphatic's

Commencement, Termination, Main area of distribution and drainage, Anastomosis

Applied aspects, Artery: Damage of vessels, Reynaud's disease, Veins: Thrombosis.

Lymphatic's: Lymphangitis (red streaks), lymphadenitis,

NEUROLOGY:

a) Nerves

Axillary, median, ulnar, musculocutaneous, radial, Origin, course, distribution, Root value

b) Plexus: Brachial

Applied aspects: Nerve injury at various sites – Tendon reflex – Winging of scapula

Erb's palsy, Klumpke's palsy, Crutch palsy, ulnar paradox

II. LOWER LIMB

REGION: boundaries, major contents; Gluteal, femoral triangle; Adductor canal, compartments of thigh, leg; popliteal fossa, Adductor canal, Sole, Arches of foot;

Gluteal IM injections

Femoral hernia

Blood supply to head of femur; Fracture neck of femur, mechanics movement of joints hip and knee, Trendelenburg test; Knee joint derangement injuries to cruciate ligaments, menisci; (tear-bucket handle type); Ankle: Sprain mechanism of venous return, varicose veins. Applied aspects of Adductor canal popliteal aneurysms.

OSTEOLOGY: - **Must to know** Identification, region, anatomical position; parts joints formed For tarsals - identification of individual tarsal's in an articulated foot.

Desirable to know

Applied aspects: Bony specialization for bipeds, walking and transmission of weight Fracture. Femoral torsion, neck shaft angle, bone grafts.

ARTHROLOGY

Hip. Knee, ankle, subtalar, Tibiofibular

Hip joint: dislocation, congenital, traumatic, surgical approaches to joints (anatomical basis), traumatic effusion, bursitis.

MYOLOGY

Attachments, nerve supply, actions of: Muscles of lower limb calf pump, antigravity muscles.

ANGIOLOGY

Artery: Femoral profunda femoris, popliteal, dorsalis pedis, Commencement, termination, main area of supply, course, relations and applied.

Vein: Venous drainage of lower limb, long and short saphenous veins, Communication and valves. Varicose

Lymphatics: Inguinal group of lymph nodes

Desirable to know: intermittent claudication, clinical significance of anastomosis: around knee, Venous thrombosis.

NEUROLOGY

a) Plexus: Lumbar and sacral, Location, Formation, Distribution

b) Nerves: Root value of sciatic, femoral, obturator, tibial, common peroneal nerves:

Origin, course, distribution, sciatica, foot drop.

Desirable to know: Pes cavus, equinovarus, clawing of toes.

III. ABDOMEN

ANTERIOR ABDOMINAL WALL

Rectus sheath, quadrants and regions, Testes, Epididymis, spermatic cord, scrotum

Desirable to know: Surgical incisions of abdomen types of inguinal hernia

Peritoneum, Lesser Omentum, Omental Bursa, Epiploic Foramen, Testes

Morphology, blood supply, lymphatic drainage

25. SPERMATIC CORD

Definition - beginning. End, course and contents, coverings, vasectomy

Abdominal organs: Morphology, relations, blood supply, lymphatics, nerve supply and applied

Anatomy of following organs

STOMACH, SPLEEN, LIVER: BILIARY APPARATUS, PANCREAS, SMALL INTESTINE, LARGE INTESTINE AND VERMIFORM APPENDIX, KIDNEYS, URETERS, SUPRARENAL GLANDS.

Desirable to know: peptic ulcer Splenic circulation, splenic vascular segments, liver, biopsy, Support of liver, Gall stones, Duct system of pancreas, Surgical approach to kidney stones (Renal), Ureter, Site of constructions, Hydronephrosis, pheochromocytoma

Nice to know: Gastroscopy, Achlorhydria, Splenectomy Liver transplant Pancreatitis, diabetes, Renal transplant, Stones in ureter, Cushing's disease.

Pelvic Viscera: Morphology, relations, blood supply, nerve supply and applied anatomy

URINARY BLADDER AND URETHRA, UTERUS, OVARIES AND UTERINE TUBES, PROSTATE, RECTUM AND ANAL CANAL, UROGENITAL DIAPHRAGM (UGD)

Desirable to know: Supports and micturition, stones in bladder ovarian cyst, enlargement complications, Fistula, Fissure piles.

Nice to know: Cystoscopy Hysterectomy cancer Supports of rectum.

Perineum - Ischiorectal fossa, pudendal canal, perianal spaces Urogenital diaphragm, male urethra, penis – perineal pouches: Ischiorectal Hernia

MYOLOGY

Must to know

Anterior abdominal wall. Rectus sheath, Psoas major, Quadratus lumborum, Thoracoabdominal diaphragm, pelvic diaphragm, thoracolumbar fascia perineal spaces and muscles.

Nice to know: Psoas abscess

OSTEOLOGY

Desirable to know: Pelvis – types

(Various diameters), lumbar vertebrae, anatomical basis of disc prolapse, nerve compression.

Nice to know: Sacralization, Lumbarization

ARTHROLOGY

Movements of lumbar vertebrae, lumbosacral, sacroiliac, sacrococcygeal joints.

ANGIOLOGY: Must to know Origin, course, termination, relations, branches and applied anatomy of PORTAL VEIN

Desirable to know: port systemic communications

Nice to know: Port systemic communications in detail: Development

INFERIOR VENA CAVA, ABDOMINAL AORTA, INTERNAL ILIAC ARTERY

IV. THORAX

Must to know

THORACIC WALL, THORACIC INLET

Boundaries and contents

THORACIC OUTLET, Boundaries and contents, muscles Atypical intercostal space.

Movement of respiration.

Desirable to know: importance and minor openings in outlet, Accessory muscles of respiration.

Nice to know: Applied aspects: Barrel chest, pectus excavatum, rickety rosary.

Divisions and major contents

Desirable to know: Mediastinitis, mediastinoscopy

SUPERIOR AND POSTERIOR MEDIASTINA LIST OF STRUCTURES

Boundaries and contents

Desirable to know: Superior mediastinal Syndrome, Course, relation and branches/ area of drainage

Nice to know: Coarctation of aorta, aneurysm, developmental anomalies.

PLEURA

Pleural reflections, recesses, innervation

Desirable to know: relations, blood supply, nerve supply

Nice to know: pleural effusion.

LUNGS

Gross description including lobes, fissures and bronchopulmonary segments.

Desirable to know : relations, blood supply, nerve supply.

Nice to know: Postural drainage, surgical importance, of bronchopulmonary segments,
Foreign body inhalation.

PERICARDIUM AND HEART

Must to know

Divisions of pericardium and sinuses

Desirable to know: referred pain

Nice to know: Pericardial effusion

HEART

Must to know

Anatomical position, location, surfaces and borders, interior of all chambers, conducting system of heart: vessels of heart.

Desirable to know: Relations, nerve supply – foramen ovale, patent IV septum, over-riding aorta, referred pain, functional end arteries – coronaries.

Nice to know: Fracture ribs, flail chest, compression fracture of vertebra.

HEAD FACE NECK

REGIONS AND ORGANS, FASCIAE OF THE NECK TRIANGLES OF NECK

Desirable to know: Spaces and spread of infections, axillary sheath, Relations of contents, Damage to accessory nerve, sialogram, approach to gland, bidigital palpation of submandibular gland and Dangerous area of face, squint.

Nice to know: surgical neck incisions, external jugular vein – air embolism. LN biopsy JVP.
Pulse, Frey's syndrome.

GLANDS

Thyroid, Parathyroid, Parotid, Submandibular, Sublingual, Pituitary

Morphology, capsule, relations, nerve supply, blood supply.

FACE

Muscles, nerve supply – blood supply.

SCALP, PALATE, TONGUE, LARYNX, PHARYNX, ORBIT, EYEBALL, STYLOID APPARATUS, NASAL CAVITY, EAR, INTERNAL EAR, MIDDLE EAR, EXTERNAL EAR, MENINGES.

OSTEOLOGY

Must to know

Identification, anatomical position, parts, foramina in the skull, structures passing through them, norma basalis, verticalis, frontalis, Lateralis, occipitalis and interior of cranial cavity.

Foetal skull: Mandible: age changes

Desirable to know: Fontanelles, Dental formula

Nice to know: Fractures of the skull, Age of dentition, cervical rib. Disc herniation

ARTHROLOGY

Must to know

TM JOINT

Desirable to know: Dislocation

MYOLOGY

Must to know

Sternomastoid, Digastric, Mylohyoid, Hyoglossus, Muscles of facial expression, mastication, larynx. pharynx, tongue, palate and Extra-ocular muscles.

Desirable to know : Relations, development.

Nice to know: facial nerve palsy.

ANGIOLOGY

ARTERIES

Must to know

Origin, parts, course, relations, branches of:

Subclavian, Internal carotid, External Carotid, Vertebral, Lingual, Facial, Maxillary artery

Desirable to know: Sub-branches distributions.

Nice to know: Subclavian steal syndrome, Subclavian-axillary anastomosis

VEINS

External and internal Jugular veins, venous drainage of face.

VENOUS SINUSES

Names, locations, drainage, classification.

EMISSARY VEINS, CAVERNOUS SINUS, LYMPHATIC DRAINAGE OF HEAD, FACE, NECK.

NEUROLOGY

Cranial nerves, Nucleus, course, relations, branches, distribution. Reflex pathways and applied anatomy, PLEXUS: Cervical, Brachial, PARASYMPATHETIC GANGLIA CERVICAL SYMPATHETIC CHAIN.

V. NEUROANATOMY

SPINAL CORD

Must to know

Gross features: Extent (child adult), enlargements, conus medullaris, filum terminale, spinal meninges Tracts Ascending and Descending.

Desirable to know: Spinal segments, vertebral correlation significance of enlargements nuclei of grey matter at upper and lower cervical mid-thoracic, Lumbar and sacral levels Clinical correlation of lesions.

Nice to know: anomalies, lamination, syringomyelia, PID. Tumours, TB, trauma, dislocation, myelography.

MEDULLA OBLONGATA

Must to know

Gross features: Motor decussation: Sensory decussation: Inferior olivary nucleus Cranial nerve nuclei.

Desirable to know: Tuber cinereum. Pontobulbar body. Order of neurons. Details of nuclei and organization of white matter.

Nice to know: medullary syndromes- Bulbar palsy, increased ICT, Arnold-Chiari malformation.

PONS

Must to know

Cross sections at the level of:

* Facial colliculus, Trigeminal nucleus

General features: Peduncles, Floor of the fourth ventricle

Desirable to know : Relations

Nice to know : Tumours, pontine haemorrhage

CEREBELLUM

Must to know

Gross features: Division, Lobes, relations, internal structure-

Desirable to know : connections of cerebellar cortex and intracerebellar nuclei, white matter classification, Purkinje neuron.

Nice to know: dysfunction-dysequilibrium ataxia hypotonia

Nuclei: Names of nuclei and important connections

Peduncles: Important tracts in the peduncles

Functions: Of archicerebellum, paleocerebellum and neocerebellum

MIDBRAIN

Must to know

General features:

Relations, contents of interpeduncular cistern connections of red nucleus

Desirable to know : T.S. at inferior colliculus, TS at superior colliculus.

Nice to know: Weber's syndrome Benedikt's syndrome

CEREBRUM

Must to know

CORTEX, WHITE MATTER, BASAL NUCLEL, LIMBIC LOBE

Surfaces, borders, major sulci, gyri, poles, lobes, major functional areas, interior gray and white matter.

Gray – cortex – granular granular./striate, Basal nuclei – names, White matter classification with examples : Components of limbic lobe

Desirable to know : handedness, Connections of limbic lobe

DIENCEPHALON

Must to know

Dorsal thalamus Epithalamus Metathalamus Hypothalamus Subthalamus Boundaries, parts, relations (gross), cavity, major nuclei, gross connections.

VENTRICULAR SYSTEM

Must to know

Parts, boundaries, foramina, correlation with parts of brain

Desirable to know: Choroid fissure, recesses, Queckenstedt's test

Nice to know: Hydrocephalus, VA shunt

BLOOD SUPPLY OF BRAIN

Must to know

Circle of Willis, subarachnoid space, arteries, veins

Desirable to know: blood brain barrier, Hemiplegia

Nice to know: End arteries, CSF formation.

MENINGES

Must to know

Cerebral and spinal meninges, folds of dura, contents of subarachnoid spaces. Arachnoid villi and granulations, direction of flow of CSF, lumbar puncture Cisterns, Definition, terminology, cisterna magna: cisternal puncture, Queckenstedt's test, vertebral venous plexus, choroids plexus, Extracerebral and intracerebral communication, CSF block puncture, Cisterns - Definition, terminology, cisterna magna

Desirable to know: cisternal puncture, Queckenstedt's test, vertebral venous plexus, choroids plexus, Extracerebral and intracerebral communication, CSF block,

Nice to know: Epidural space.

C) MICROANATOMY

GENERAL HISTOLOGY

Must to know

MICROSCOPE

Light microscope: parts, magnification, resolution, Electron microscope

Desirable to know: Micro techniques, H and E staining

Nice to know: Polarizing microscope, phase contrast, scanning EM

CYTOLOGY

Must to know

Cell, Cytoplasm and nucleus, Cytomembranes, Unit membrane, Cell organelles

Mitochondrial DNA, mitochondrial myopathy

Desirable to know: Specialisations of cell surface, Sarcoplasmic reticulum of muscle, Primary and secondary lysosomes, residual bodies, Effect of colchicines and anticytotic drugs on spindles preventing mitosis, Endocytosis, exocytosis, movement of microvilli: Cell mitotic activity.

Nice to know: Lysosomal storage disease

Nucleus – Structure, nuclear envelope, chromatin, Barr body, nucleolus

Epithelial

Must to know

Definition, Classification, Structure of various types & subtypes of epithelia

Desirable to know: Nutrition, Renewal, Innervation

Nice to know: Metaplasia

Surface modifications, Cilia; Microvilli: Stereocilia; Cell junction and junctional complexes.

Glands, Must to know Classification; Unicellular and Multicellular; Exocrine, Endocrine
Amphicrine. Exocrine: Simple, Compound Apocrine, Merocrine, Holocrine; Tubular, alveolar, tubuloalveolar; Serous; Mucous; Mixed.

Connective tissue

Must to know Classification, structure, fibres, ground substance, loose areolar tissue, adipose tissue.

Desirable to know: Glycosaminoglycans

Nice to know: Scurvy, oedema, inflammation.

Bone & Cartilage

Must to know

Bone, Compact, Cancellous, Developing bone; ossification, Woven, lamellar bone Cartilage, Classification, types, Perichondrium functions.

Desirable to know: Growth: Interstitial, Appositional: Bone callus, Osteomalacia, Osteoporosis
Osteoma

Nice to know: Chondroma

Muscle

Must to know

Skeletal muscle Plain muscle Cardiac muscle Intercalated disc, syncytium; Sarcomere, I and A bands, myofibrils, myofilaments: Sarcoplasmic reticulum

Desirable to know: Innervation, Red fibres, white fibres

Nice to know: Hypertrophy, Hyperplasia, Rigor mortis, Myasthenia gravis.

Nervous

Must to know

Neurons, types: Neuroglia, types: Myelinated nerve fibre LS: Non-myelinated nerve fibre; Peripheral nerve: Nodes of Ranvier: Synapses:

Vessels

Must to know

Large sized artery Medium sized artery, Arteriole: Capillary, Sinusoid: Medium sized vein;

Desirable to know : Atherosclerosis, Aneurysm, Infarcts, clotting

Lymphoid tissue, T cells, B cells; Mucosa Associated Lymphoid Tissue; Humoral immunity, Cell mediated immunity; Lymph node *section*; Thymus, Spleen, Tonsil. Blood-thymus barrier, Open and closed circulation in the spleen

Nice to know: Organ transplantation, Graft rejection Autoimmune disease.

SYSTEMIC HISTOLOGY

Must to know

Basic organization, salient features, Identification

Structure and function correlation, individual features.

Integumentary system

Skin Types: Epidermis and dermis; various cells, Appendages of skin

Desirable to know : Renewal of epidermis.

Nice to know; Albinism, melanoma, Acne.

Alimentary system

Must to know

Oral tissues

Lip, Tongue, taste buds, Papillae; Tooth, Developing tooth, Salivary glands

Desirable to know: Striated duct, ion transport

GI Tract

Must to know

Basic organization – 4 layers: Oesophagus with glands Stomach – Fundus, Chief cells, Parietal cells, intrinsic factor; Stomach – Pylorus Duodenum Brunner's glands; Small intestine – with Peyer's patch, Appendix, Large intestine.

Nice to know: Pernicious anaemia, ulcer, gastritis, Hirschsprung's disease or megacolon

Must to know

Pancreas: Exocrine, islets of Langerhans; Liver, Hepatic lobule, portal lobule; portal acinus; Gall bladder: Liver as an endocrine gland

Nice to know: Diabetes mellitus, Cirrhosis of liver, liver regeneration, Chalcones.

Respiratory system

Must to know

Olfactory mucosa; Epiglottis; Trachea, Lung, Bronchus, bronchiole, alveolar duct, sac, Alveoli, pulmonary type I and II cells.

Desirable to know: Double spirally arranged bronchial smooth muscle.

Nice to know: Bronchial asthma, Hyaline membrane disease, Heart failure cells

Urinary system

Must to know

Basic organization; Nephron – Parts podocytes, Collecting system, Kidney – Cortex , Medulla
Ureter; Urinary bladder, Urethra

Desirable to know: Juxtaglomerular apparatus.

Male reproductive system

Must to know

Basic organization; Gonads, Tract, Accessory glands; Testis; Epididymis; Vas deferens: Prostate:
Penis; Seminal vesicle.

Desirable to know : Stages of spermatogenesis

Nice to know: Immotile sperm

Female reproductive system

Must to know

Basic organization: Gonads, Tracts, Accessory glands; Ovary – with corpus luteum; Fallopian
tube; Uterus;; Cervix, Vagina, Mammary gland Active, Passive

Desirable to know: Stages of maturation of ovarian follicle, Phases of menstruation Colostrum,
IgA, Placenta: Maternal unit, Foetal unit, Umbilical cord; Wharton's jelly

Endocrine system: Pituitary: Adenohypophysis, Neurohypophysis;

Must to know

Thyroid; Follicular, parafollicular cells; Parathyroid; Chief cells, oxyphil cells; Adrenal;
Pancreas: Testis: Ovary

Desirable to know: Hypothalamo-pituitary Portal system

Nice to know: Pheochromocytoma

Nervous system

Must to know

a) Central

Basic organization; Cerebrum; Cerebellum; Spinal cord: Cervical; Thoracic; Lumbar, Sacral;

b) Peripheral

Sensory ganglia; Autonomic ganglia (sympathetic ganglion): Peripheral nerve

Special senses

Visual: Eyeball Cornea: Sclerocorneal junction: Canal of Schlemm; Lens: Retina; Optic nerve
Nice to know: Keratoplasty eye donation, glaucoma, retinal detachment

Auditory:

Must to know

Internal ear: Cochlea; Semicircular canals; Vestibule:

Olfactory

Must to know

Nasal cavity

Gustatory

Must to know

Tongue with taste buds.

D) DEVELOPMENT ANATOMY

Must to know

GENERAL EMBRYOLOGY

Introduction: Stages of human life phylogeny

Ontogeny, Trimester, Viability,

Terms of reference: e.g. Cranial, Rostral, Caudal, Dorsal, Ventral, Lateral, Medial Median,
Planes of Section

Nice to know: The law of recapitulation, “Critical period” malformations, USG, Amniocentesis
Chorionic Villus Biopsy, Fetoscopy, etc., Teratology History of Embryology.

Gametogenesis: Menstrual cycle other reproductive cycles, Germ cell Transport and
Fertilisation, Sperm capacitation, Methods of contraception. Sex determination.

Nice to know: Teratogenic influences; Fertility and Sterility, Surrogate motherhood; Social
significance of “Sex-ratio”

Must to know

Cleavage, Blastocyst, Cytotrophoblast, Syncytiotrophoblast

Implantation: Normal sites, Abnormal sites; Placenta praevia, Extra-embryonic Mesoderm and Coelom; Bilaminar disc – Prochordal plate.

Desirable to know: “abortion” Decidual reaction, Chorionic Gonadotropins – Pregnancy test.

Must to know

Primitive streak Notochord, Neural tube and its fate Neural crest cells their fate, Development of somites, Intra-embryonic coelom, Foetal membranes: Chorionic villi. Amnion, Yolk sac, Allantois.

Desirable to know: Congenital malformations, Nucleus pulposus, Sacrococcygeal teratomas Neural tube defects, Anencephaly

Nice to know: Signs of pregnancy in the first trimester, Role of teratogens, Alpha-fetoprotein level

Must to know

Folding of the embryo: Derivatives of germ layers, Pharyngeal arches

Desirable to know : Thalidomide tragedy, Estimation of Embryonic Age – Superfoetation and Superfoecundation.

Fetal membranes: Formation Functions, fate of Chorion; Amnion: Yolk sac: Allantois, Decidua; Umbilical cord; Placenta – Physiological function Foetomaternal circulation, Placental barrier, Twinning; Monozygotic, dizygotic.

Desirable to know: Placental hormones, Uterine growth, Parturition, Estimation of fetal age.

Nice to know: Types of cord attachments, Chorion villus biopsy and Amniocentesis; Uses of amniotic membranes, Trophoblastic tumours – Rh incompatibility, Haemolytic disease of newborn.

Systemic Embryology

Must to know

Cardiovascular System – Venous System: Heart – Chambers – Septa – Truncus – Aortic arches – Fetal circulation – Changes at birth, ASDs, VSDs, PDA, Fallot’s Tetralogy.

Desirable to know: Veins, abnormalities, Surgical corrections.

The Respiratory System:

Must to know

Development of Larynx, Trachea, Bronchi, Lungs: Tracheo-oesophageal Fistula

Desirable to know : malformations

Nice to know: Respiratory Distress Syndrome: Premature births.

Must to know

The Alimentary System: Foregut: Oesophagus, Stomach, (Lesser sac) Duodenum-Hepatobiliary apparatus, Pancreas, Spleen, Portal vein; Midgut: Rotation and Fixation Caecum and Appendix, Meckel's Diverticulum; Hindgut: Cloaca: Rectum and Anal Canal.

Desirable to know: Malformation – Tracheo-oesophageal fistulae; Congenital Hypertrophic Pyloric Stenosis; Atresia; Omphalocele; Hernia; Malformations – Fistulae, Situs Inversus; Nonrotation; Mixed rotation of gut.

Must to know

The Urogenital System, Development of Kidneys and Ureters; Cloaca – Urinary Bladder and Urethra; Suprarenal gland; Genital System – Testis and Ovary; Ducts and associated glands; External genital organs, Mesonephric and paramesonephric Ducts. Uterine tube, Uterus and vagina.

Desirable to know: congenital malformations; Ambiguous genitalia and Hermaphroditism; Remnants and Vestiges of Ducts and Tubules.

Must to know

Integument: Development of mammary gland. Skin and appendages.

Pharyngeal arches, nerves, muscles, cartilage development of face, palate.

Endocrine: Glands, Adrenal, Thyroid, Parathyroid, Pituitary

The Nervous System: Neural Tube: Spinal Cord and Brain i.e. Forebrain, Midbrain and Hindbrain, Hypophysis cerebri; Neural Crest, Peripheral Nervous System.

Desirable to know: correlation Spina bifida: Anencephaly, Hydrocephalus, Retinal detachment; glaucoma; Coloboma iris.

Nice to know: Myelination of tracts, shortening of spinal cord, Neural Tube Defects

Must to know

Organs of the special senses – Eye and ear

Ear – Internal ear – External and middle ear – anomalies of the Ear

E. GENETICS

Must to know

Introduction- Mendelism, Laws Genetic code

Desirable to know: Evolution, Eugenics and Polygenic inheritance, Radiation and mutation, Sex chromatin, Population genetics.

Cytogenetics Structure and function of chromosomes, Cell cycle, Cell divisions, Spermatogenesis, Oogenesis

Molecular genetics (Normal): Gene, Genetic code, Structure and types of DNA. Structure of RNA

Inheritance: Single gene inheritance, Multifactorial inheritance, Polygenic inheritance, Mitochondrial inheritance, Pedigree charts with symbols.

Genetic basis of variation: Mutation, Polymorphism, Multiple allelism

Desirable to know: Types, Factors influencing mutational load

Developmental genetics: Chromosomes; Lyon's hypothesis, Hermaphroditism and pseudohermaphroditism; Teratogenesis Gonadal dysgenesis, Adrenogenital syndrome Androgen insensitivity

Nice to know: Counselling

Pedigree charting, Chromosomal basis of disease: Numerical, Structural abnormalities Down's, Cri-du-chat, Turner's, Klinefelter's

Desirable to know : Dermatographics

Nice to know: Counselling

Prenatal diagnosis: Maternal Serum Sampling; Fetal USG; Fetal Amniocentesis; Fetal Chorion Villus Sampling

Desirable to know: (cordocentesis); Foetoscopy

Nice to know: Eugenics.

F. RADIOLOGICAL ANATOMY

Must to know

Introduction

Principles of plain radiograms and CT scan

Identification of gross anatomical features in plain and contrast radiographs

Identification of gross anatomical features in normal CT scan especially of the Abdomen and Head-Face-Neck-Brain regions.

Diagnostic procedures. Technical details (e.g. dye) are not necessary.

Desirable to know: Estimation of age if epiphyseal line seen.

I. UPPER LIMB – X-Ray of

Shoulder region

Arm

Elbow region

Fore arm

Wrist and hand

II. LOWER LIMB must to know

Hip region

Thigh

Knee region

Leg

Ankle region

Foot

III. ABDOMEN

Plain X-ray

Barium meal

Barium meal follows through Bronchogram

Barium enema

Oral cholecystogram

Intravenous urogram

Cystogram

Ascending pyelogram

Abdominal Aortogram

Hystero-salpingogram

Myelogram

CT abdomen

IV. THORAX must to know

Plain X-ray

Barium swallow

CT mediastinum

High resolution CT lung

V. HEAD-FACE

X-ray skull plain

Carotid angiogram

Vertebral arteriogram

CT scan Brain

VI) NECK Must to know

Plain X-ray cervical region

G. SURFACE ANATOMY

Must to know

I. SURFACE MARKING:

Upper Limb

NERVES: Radial nerve, Median nerve, Ulnar nerve, Axillary nerve, Musculocutaneous nerve

VESSELS: Axillary artery, Brachial artery, Radial artery, Ulnar artery, Superficial and deep palmar arches.

Lower Limb

NERVES: Femoral, Sciatic, Common peroneal nerves

VESSELS: Great saphenous and Small saphenous veins; Femoral, Popliteal and Dorsalis pedis arteries.

ABDOMEN

ORGANS: 9 regions and projection of organs in them; Stomach, Duodenum, Caecum. Appendix. Ascending, transverse and descending colon. Pancreas, Liver, Gall bladder, Spleen, Kidneys (ventral and dorsal) Abdominal aorta

THORAX

Heart and valves, Lungs, fissures and hilum; Pleurae, Trachea

HEAD FACE NECK

ORGANS: Parotid gland and duct Middle meningeal artery, Facial artery Pterion, Bregma, Reid's base line, Suprameatal triangle, Thyroid gland, Common carotid artery, External carotid artery, Internal carotid artery, Internal Jugular vein, Trachea

Brain Lateral sulcus, Central sulcus, Median longitudinal fissure, Superior sagittal sinus, Sigmoid sinus, transverse sinus.

Deleted

II. LIVING ANATOMY

Upper Limb

PALPATION OF BONY LANDMARKS

Clavicle, Spine of scapula, Inferior angle, Coracoid process, Epicondyles of humerus, Olecranon process of ulna: Head and styloid processes of radius and ulna, Heads of Metacarpals (knuckles), Pisiform, Hook of Hamate

JOINTS (DEMONSTRATION OF MOVEMENTS)

Shoulder girdle, Shoulder joint, Elbow joint, Radio-ulnar joints, Wrist joint, 1st Carpo-metacarpal joint, MP and IP joints.

MUSCLES (DEMONSTRATION OF ACTION)

Principle of testing: Trapezius, Serratus anterior, Latissimus dorsi, Pectoralis major Deltoid, Biceps Brachii, Brachioradialis, Brachialis, Extensors at the elbow, Supinators, Wrist extensors, Wrist flexors, Small muscles of the hand

NERVES: Dermatomes, Ulnar, Ulnar nerve thickening in Leprosy

VESSELS (PALPATION): Axillary artery, Brachial artery, Radial artery

OTHERS: Axillary groups of lymph nodes; Anatomical snuff-box (boundaries)

Lower Limb

PALPATION OF BONY LANDMARKS Anterior superior iliac spine, Iliac crest, Tubercle of the iliac crest, Ischial tuberosity. Greater trochanter, Adductor tubercle, Head and neck of fibula, Lateral and medial malleoli, Tibial tuberosity, Subcutaneous surface of tibia, Patella

JOINTS (DEMONSTRATION OF MOVEMENTS): Hip, Knee, Ankle, Subtalar Joint

JOINTS (DEMONSTRATION OF ACTION): Hip-Flexors, Extensors, Abductors, Adductors

Knee: Flexors, Extensors,

Ankle: Dorsiflexors, Plantar flexors

Subtalar: Invertors, Evertors

NERVES: Dermatomes, Sciatic, Tibial, Common peroneal Femoral, Obturator
Thickening of common peroneal nerve in Leprosy

VESSELS (PALPATION OF) Femoral, Popliteal, Dorsalis pedis, Posterior tibial

OTHERS: Ligamentum patellae, Inguinal lymph nodes

TENDONS: Semitendinosus, Semimembranosus, Biceps femoris, Iliotibial tract.

ABDOMEN

(BONY) LANDMARKS (PALPATION OF): Anterior superior iliac spine, Pubic tubercle.

JOINTS (DEMONSTRATION OF MOVEMENTS): Intervertebral

MUSCLES (DEMONSTRATION OF ACTION): Obliques, Transversus abdominis, Rectus abdominis

NERVES: Dermatomes

OTHERS: Enlarged liver, spleen, kidneys Abdominal quadrants and regions:

Position of superficial and deep inguinal rings: Renal angle: McBurney's point:

Desirable to know: Murphy's sign

THORAX (BONY) LANDMARKS (PALPATION OF):

Sternal angle, counting of rib spaces, locating thoracic spines.

JOINTS (DEMONSTRATION OF MOVEMENTS): Intervertebral

MUSCLES (DEMONSTRATION OF ACTION): Respiratory movements

NERVES: Dermatomes

OTHERS: Apex beat, Apices of the lungs, Triangle of auscultation.

HEAD FACE NECK – (BONY) LANDMARKS (PALPATION OF): Nasion, Glabella, Inion, Mastoid process, Supraorbital triangle, Zygoma, Zygomatic arch, Angle of mandible Head of mandible.

JOINTS (DEMONSTRATION OF MOVEMENTS): Temporomandibular joint

MUSCLES (DEMONSTRATION OF ACTION): of Mastication, of Facial Expression,

Cranial nerves (I to XII) testing

(PALPATION OF) Superficial temporal artery, Facial artery

(PALPATION OF): Symphysis menti, Hyoid bone, Thyroid cartilage, Cricoid Cartilage, Tracheal rings, Suprasternal notch, Transverse process of atlas, Spine of C7

DEMONSTRATION OF MOVEMENTS): Atlanto-occipital joint, Cervical joints

(DEMONSTRATION OF ACTION): Sternocleidomastoid, Neck flexors and Extensors

(PALPATION OF) Common carotid artery, External carotid artery

OTHERS: Thyroid gland, Cervical lymph nodes,(Horizontal and vertical), Midline Structures in the neck.

NOTE: Level 2 and 3 mentioned in the above syllabus includes the topics “desirable to Know” (level-2) and “Nice to know” (level-3. The remaining topics fall under the group “Must know” (level-1).

1. TRAINING PERIOD AND TIME DURATION

The period of 4 ½ years is divided into three phases as follows

Phase 1-two semesters (each semester of 6 months) 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 some what equally divided between anatomy and physiology plus bio chemistry combined.(physiology 2/3 and bio chemistry 1/3).

Each semester will consist of 120 teaching days of 8 hours working time including 1 hour of lunch break.

2. ACADEMIC TERMS

All the candidate admitted beyond the last date stipulated by the university shall have to appear for the first professional examination to be held subsequent to the regular examination after completion of the prescribed duration.

3. ATTENDANCE

Every candidate should have attendance minimum of 75% of the total classes conducted in theory and practical's jointly in each calendar year calculating 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 gazette medical education(amendment)regulations 2003 published in the gazette of India part 3, section-4 extraordinary issued on 15 the October 2003].

The attendance details at the end of each term should be submitted to the principal without fail for onward intimation to the university.

The candidate lacking in prescribed attendance and progress in the subject in theory or practical for the first attempt should not be permitted to appear for the examination in that subject.

Distribution of Teaching hours for Phase-1

Total number of working days	-	240 days
Total working hours per day	-	07 hours
Total working hours for phase-1	-	1680 hours
Total working hours for community medicine	-	60 hours
Total working hours for pre clinical	-	1620 hours
Total working hours for anatomy	-	810 hours

Details of working hours for Anatomy

Lectures	-	5 hours/week
Tutorials	-	1 hour/week
Demonstration/Short lecture	-	1 hour/week
Practical	-	2 hours/week
Dissection/group discussion	-	10 hours/week
Total working hours per week	-	19 hours

Distribution of number of hours for Theory & Practical Classes

I) A. Theory Classes:

1. General Anatomy	-	10 hours
2. Upper limb	-	20 hours
3. Lower limb	-	25 hours
4. Head and Neck	-	25 hours
5. Brain	-	15 hours
6. Thorax	-	15 hours
7. Abdomen and Pelvis	-	30 hours
8. Histology	-	40 hours
9. Embryology	-	40 hours
Total hours of Theory Classes	-	220 hours

B. Tutorial Classes: 80 hours

II) Practical Classes:

A) Dissection

1. Upper limb	-	60 hours
2. Lower limb	-	60 hours
3. Head and Neck	-	120 hours
4. Brain and Eyeball	-	40 hours
5. Thorax	-	40 hours
6. Abdomen and Pelvis	-	100 hours
Total hours of Dissection Classes	-	420 hours

B) Histology - 80 hours

Teaching – learning methods in theory classes, practical etc.

Sl. No	Date	Topic	Hrs	TLM
1		Descriptive Terms	1	Interactive session, Chalk & Talk
2		General Osteology	1	Demonstration
3		General & Systemic Embryology	40	PPT , OHP Presentation, Embryology models
4		General & Systemic Histology	40	PPT Presentation, Slide demonstration
5		Joints	10	Demonstration of movements
6		General Anatomy	10	Chalk & Talk
7		Radiological Anatomy	06	Demonstration of X rays, CT Scan, MRI
8		Systemic Anatomy		Demonstrating the Dissected cadaver
9		Thyroid Gland, Abdominal Viscera		Integrated Teaching
10		Neuro Anatomy	07	Demonstration, Taking Theory Classes
11		Surface Anatomy & Living Anatomy	06	Demonstrating on the Cadaver & Living Persons
12		Genetics	06	PPT Presentation, Chart Discussion

Various Techniques for INTERACTIVE TEACHING:

Putting questions to the audience: Questions can stimulate interest, arouse attention in students. Questions asked should be simple and to the point. The teacher's way should be non-threatening. He or she should wait for a response of the student.

Small Group Teaching: Class can be divided into small groups of two and four students sitting in the neighborhood and then asked to discuss one topic in a few minutes. This technique gives teacher an additional way of assessing student. This is powerful and affective method but noise produced during discussion is its drawback.

Brain Storming: Brain storming refers to that process whereby students generate a list of issues – in response to a specific question or topic. In the beginning of a lecture it is an invitation to everyone in a group to participate, in the middle it can be helpful to change the pace, to regain student's attention and at the end it allows the students to summarize the information discussed. (Newble & Cannon, 1994; Schwenk & Whiteman, 1987; Geuna S, 2002)

Quizzes and Short Answers: Quizzes or short answers can be used at the beginning or end of a class to provide a "check-up" on learning to summarize the information.

Computer Aided Teaching: Interactive teaching in a large group can be done with the help of computers. An alternative approach is the use of flash cards. (Kennewell S et al 2007)

Handouts: Handouts are written material helpful to the teacher as well as students. Handouts of slides (Amato & Quirt, 1990), (Maureen Tam et al 1993) allow students to participate more in thinking about the concepts rather than writing down every word of the lecture. The literatures on handouts give higher scores in test.

Audio Visual Aids: Overhead projectors allow the presenter to maintain eye contact with the students. Flip charts and white boards allow for the creation of diagram which is very helpful in medical science. Multimedia and computer assisted learning also promotes interaction.

Interactive models: More recently, interactive models have been developed that respond to actions taken by a student or physician. Until recently, these simulations were two dimensional computer programs that acted more like a textbook than a patient. Computer simulations have the advantage of allowing a student to make judgments, and also to make errors. The process of interactive learning through assessment, evaluation, decision making, and error correction creates a much stronger learning environment than passive instruction.

(5) Virtual World Patient (patient is a computer generated character - an avatar - living in a virtual world environment).

Artificial patient software and patient simulators are becoming increasingly commonplace in medical schools all over the world. Simulated patient databases however take considerable time, effort and resources to establish and are often created more than 90 percent of medical schools in the United States have eliminated animal laboratories from their curricula. The majority of medical schools in the U.S., including Harvard, Stanford, and Yale, have replaced their use of live animals in physiology, pharmacology, and/or surgical-training exercises with humane and effective non-animal teaching methods, including observation of actual human cardiac bypass surgery, patient simulators, cadavers, sophisticated computer programs, and more. An increasing number of veterinary schools have been able to employ similar humane educational alternatives, thereby saving the lives of countless animals who in the past would have been killed for the purposes of dissection or suffered through unnecessary surgeries. In addition to being more humane, non-animal teaching tools such as computer simulations, multimedia CD-ROMs, and models are also more economical than traditional animal-based teaching exercises. (Balcome J2000) Whereas the “traditional” approach involves the acquisition and disposal of animals on an ongoing basis, purchasing a set of CD-ROMs represents a one-time expenditure for a product that can be used repeatedly for many years. Schools can save tens of thousands of dollars each year by implementing reusable replacements for animal “specimens. Advances in medical simulation technology and computer-based interactive learning, increased awareness of ethical concerns, and progressive curriculum reform recognizing the need for human-based learning are a few of the many factors that have contributed to the replacement of live animals in medical education.

Card Test: Weekly we are conducting card test of that week dissected portion, this also arouse the interest student

Gross & Histology Journals: We ask the students to draw histology & gross diagrams in their respective journals by this they understand more.

Debates, Seminars and Guest Lectures: Debates can be conducted and the student on either side can be asked to support two different sides of the issue. (Frederick, 1986, 1987) similarly, seminars and guest lectures should be conducted after completion of one topic. All these will help in arousing attention in students and thus increasing inter activity.

INTERNAL ASSESSMENT

THEORY

Minimum 3 examinations recommended. They should be conducted like university examination pattern. Average marks of the best two notified internal examination should be reduced to 60.

If the student is absent for internal assessment examination, the cause is genuine provision should be made for the examination on other notified date.

Day to day assessment should be given 10% weight age. The marks will be given on the basis of the:

1. Part completion test
2. Tutorial test
3. Card test-which will include 50% oral and 50% MCQ's
4. . Seminar presentation and participation.

All the records should be maintained and must be ready for the verification from the university and if asked by the students.

Theory, Practical, Viva will be given equal weight age for I.A.

For eligibility to write examination student should get minimum of 35% in I.A.

PRACTICALS

Total practical assessment out of 20

5 marks are allotted for the records (Gross + Histology) and 2 best practical examination should be taken into consideration. Attained marks should be reduced to 15, added to the marks awarded for records.

Internal Assessment Marks should be notified to the students well in advance and their signature to be taken before submitting to the university.

UNIVERSITY EXAMINATION

DISTRIBUTION OF MARKS

Theory

Paper -1

Above diaphragm (100 marks)

2 long questions	-	2X10=20 marks
10 short essays	-	10X5= 50 marks
10 short answers	-	10X3= 30 marks

Paper - 2

Below diaphragm (100 marks)

2 long questions	-	2X10=20 marks
10 short essays	-	10X5=50 marks
10 Short answers	-	10x3=30 marks

2. Viva-Voice (40 marks)

Above diaphragm	-	10 marks
Below diaphragm	-	10 marks
Radiology	-	10 marks
Embryology	-	10 marks

THEORY (200 MARKS)

Paper-1 (100)

Marks allotted for each region

Head & Neck -----	35
Brain/spinal cord -----	10
Upperlimb -----	20
Thorax & diaphragm -----	20
General embryology } General Histology } General anatomy }	-----15

Paper-2 (100)

Marks allotted for each region

Abdomen -----	35
Pelvis and perineum -----	15
Lower limb -----	20
Systemic Histology -----	10
Genetics -----	10
Systemic embryology -----	10

Practical (80 marks)

1. Gross Anatomy ----- 50

A. Spotters-identification of structures in given specimen - 5x2=10 marks.

B. Surface marking -----10 marks

C. Discussion:

Above diaphragm----- 15 Marks

Below diaphragm -----15 Marks

2. Histology ----- 30 Marks

A) Spotters---Identification of 9 Slides and Interpretation of one Genetic chart 10x1 = 10 Marks

B) Discussion of two Given Slides ---- 10x2 =20 Marks

3. Viva-voce ----- - 40 marks

Above diaphragm ----- 10 marks

Below diaphragm ----- 10 marks

Embryology ----- 10 marks

Radiology ----- 10 marks

Colour Pencils and Sketch Pens to be used for gross diagrams and Haematoxyllin and eosin pencils for histology.

During setting of the theory paper allotment of marks on the basis of three levels will be as

Level 1 75%

Level 2 15%

Level 3 10%

Time slot for viva for a candidate minimum 03 minutes and maximum up to 06 minutes.

Anatomy Books Recommended

1. Gray's Anatomy
2. Sahana's Human Anatomy
3. Text Book of Anatomy Henry/ Rosse
4. Grant's Methods of Anatomy
5. Essentials of Human Anatomy A.K.Datta Vol. 1 to 3
6. Cunningham's manual of Practical Anatomy Vol. 1 to 3
7. Regional Anatomy by R.J.Last
8. Human Histology by Inderbir Singh
9. Atlas of Human Histology-DIFORE
10. Histology by Ham
11. Text book of Histology and Practical Guide -JP Gunasegaran
12. Surgical Anatomy- McGregor
13. Human Embryology- Inderbir Singh
14. Human Embryology by Sudhir Sant
15. Medical Embryology- Langman
16. Developing Human – Keith Moore
17. Surface Anatomy and Radiology- Halim
18. General Anatomy- B.D.Chourasia
19. General Anatomy by A.K.Datta
20. Text Book of Neuroanatomy- Inderbir Singh
21. Clinical Anatomy for Medical Students by Richard Snell
22. Human Osteology by Inderbir Singh
23. Human Genetics – SD Gangane
24. J.S.P.Lumbley et.al – M.C.Q's in Anatomy
25. Gray's anatomy for students – Drake
26. Dorland's Medical dictionary
27. Clinically Oriented Anatomy – Keith.L.Moore

UG SYLLABUS IN PHYSIOLOGY

Goal:

The goal of teaching Physiology to undergraduate students is to make them understand the Physiological Principles and Homeostatic mechanisms of Normal Human body so that he/she can understand the disease pattern better.

Objectives:

1. Learn normal functioning of all organs, systems and their interactions for well co-ordinated body function.
2. To assess relative contribution of each organ system to the maintenance of the milieu interior.
3. Elucidate the Physiological aspects of normal growth and development.
4. Describe the Physiological response and adaptations to environmental stress.
5. List Physiological Principles underlying pathogenesis and treatment of disease.
6. To apply Physiologic knowledge in Research activities.
7. To initiate to participate in Seminar.

Knowledge:

At the end of the course the student will be able to.

1. Describe the normal functioning of all the organ systems, regulatory mechanisms and interactions of various organs for well co-ordinated total body function.
2. Understand the basic Principles, mechanisms and homeostatic control of all the functions of human body as a whole.
3. Lay emphasis on Physiological basis in diagnosis and Management of diseases.
4. Correlate knowledge of Physiology in area indicated by National Health Programme.

Skills:

At the end of the course, the student shall be able to acquire the skills

1. To conduct the experiments for study of Physiological functions.
2. To interpret experimental and Investigative data.
3. To distinguish between normal and abnormal data derived as a result of Tests which he /she performed and observed in the Laboratory.
4. To understand different types of Biomedical waste, their potential risk and their management.

Integration:

At the end of the Integrated Teaching, the student shall acquire an integrated knowledge of organ structure and function and the regulatory mechanisms including Biophysics.

Teaching Hours

Total No. of Hours	:	480 hrs.
Theory didactic Lectures	:	160 hrs.
Non Lecture Teaching (Tutorials + Group Discussion)	:	40+40 hrs.
Practical /Demonstrations	:	240 hrs.

Course Contents

Theory	:	160 hrs.
1. General Physiology including Biophysics.	:	08 hrs.

Must know

History of Medicine with special reference to Physiology, Body Fluids Compartments, changes in Body Fluid and their Measurements Hypoproteinemia. Homeostasis, Concepts of Physiological norms range and variations, Transport across Cell membrane, relationship between stimulus and response. Structure of cell membrane, RMP, Cellular receptors, Intercellular communications.

Desirable to know

Apoptosis, Aging, Genetics overview

Nice to know: *Biopotentials*, Principles and uses of tissue grafting.

2. Blood & Lymph: 16 hrs.

Must know

Blood composition; cellular elements of blood their formation and regulation. Hemoglobin: Synthesis and functions Jaundice, Anemia & their Classification, Hemostatic mechanisms, Anticoagulants, Blood groups, Rh- incompatibility Blood transfusion, ESR, Basic Mechanisms of Immunity & Function of WBC, Lymph : Composition Circulation and functions. *Reticulo endothelial system, morphology and function of Platelet*

Desirable to know

Principles and uses of blood components and blood components therapy

Nice to know: *Blood Bank.*

3. Gastro intestinal Tract:

12 hrs.

Must know

Functional Morphology Smooth Muscle: Structure Mechanism of Contraction. Nerve supply and Nerve transmitters. Composition Function and regulation of secretion of Salivary glands, Stomach, Small Intestine, large Intestine, Pancreas and bile.

Regulation of gastrointestinal Movements, Functions of Gall bladder, liver. Site of production and action of GI Hormones. Mechanism of Absorption of food.

Pathophysiology and Physiological basis of treatment of Peptic ulcer, Diarrhoea and Constipation.

Motility disorders: Achalasia, Hirschsprung disease.

Nutrition: Introduction to Nutrition, BMR, Carbohydrates and dietary fibres, Proteins and Fats, Recommended dietary allowances,

Desirable to know

Balance diet, Effect of starvation, Pathophysiology and Physiological basis of treatment of obesity

Nice to know: *Diet during infancy, Childhood, pregnancy and lactation, Obesity and its complications.*

4. Respiratory System:

12 hrs.

Must know

Functional anatomy of Respiratory systems, Mechanics of Normal respiration, Physical Principles governing flow of air in respiratory passages, Dead space, Lung Compliance, Alveolar ventilation, ventilation perfusion Ratio, Oxygen and CO₂ transport, Diffusing capacity, pulmonary function Tests.

Regulation of respiration, Respiratory acidosis and alkalosis, Pulmonary blood flow, Hypoxia, Cyanosis, Asphyxia, Respiratory adjustments during muscle exercise, Hyperbaric conditions, Principles of Oxygen therapy, Artificial respiration, Hyaline Membrane disease, Pathophysiology of Restrictive and obstructive lung diseases, Pulmonary edema, Decompression sickness, Hyper baric Oxygen therapy and Dyspnoea.

Physiological response to high altitude and high atmospheric pressure, Space Physiology.

Desirable to know

Technique and uses of computerized pulmonary function testing

Nice to know: Principles and uses of blood gas analysis

5. Cardiovascular System:

25 hrs.

Must know

Functional anatomy of heart, properties of cardiac muscle, Cardiovascular Regulatory Mechanisms, Principles of Electro cardiography, Electrical and Mechanical changes in cardiac cycle, Conducting system of Heart, Normal ECG, Cardiac output: Values, Measurement in Man, Physiological Variations and Regulations.

Regulatory mechanisms of Heart rate and Blood pressure. Physical Principles governing flow of blood in Heart and blood vessels, Measurement and regulation of coronary blood flow, Cerebral blood flow and blood circulation in skeletal system, changes in CVS during muscular exercise, Postural changes, Hypovolemia, Hypoxia, and cardio pulmonary resuscitation. Microcirculation. Hemodynamics Pathophysiology of Hypertension, Shock, cardiac failure and coronary Artery Disease, Exercise Physiology.

Desirable to know

Abnormal ECG, Principles and uses of Stress test

Nice to know: Principles and uses of echocardiography.

6. Kidney:

10 hrs.

Must know

Functions of different parts of Nephron, Functions of Kidneys, Mechanism of urine formation, Role of Kidney in water and Electrolyte balance. Acidification of urine. Diuresis, Kidney function tests. Juxtaglomerular apparatus. Renin - Angiotensin system, Renal blood flow. GFR: Normal value, its measurement and regulation. Innervation of bladder, Micturition, Cystometrogram, Disorders of Micturition and Principles of Artificial kidney.

Environmental Physiology: Introduction, Body temp. regulation, Man in hot and cold environment.

Desirable to know

Classification, uses and disadvantages of Diuretics

Nice to know: Induced *Hypothermia and its uses.*

7. Muscle Nerve Physiology:

08 hrs.

Must know

Classification of Nerves and Muscle, Structure of skeletal muscle. Types of muscle fibers. Mechanism of contraction and Its molecular basis.

Thermal and chemical changes during muscle contraction. Oxygen debt. Neuromuscular Transmission Neuromuscular blocking drugs. Neuromuscular disorders Pathophysiology of Myasthenia Gravis. *Energetics of Nerve and muscle, Injury and repair of Nerves and Muscle, Types of contraction*

Desirable to know

Experimental techniques to study bioelectrical phenomena such as cathode ray oscilloscope and nerve conduction studies.

Nice to know: *Work Physiology*

8. Endocrine glands :

16 hrs.

Must know

Types of Endocrine glands and hormones, Mechanism of action of hormones, General Principles of Regulation of Endocrine glands. Hormonal functions, cellular mechanism of hormone action, regulation of secretion.

Experimental and clinical disorders of Anterior and Posterior Pituitary, Hypothalamus, Thyroid, Parathyroid, Adrenal Cortex and Medulla and Endocrine Pancreas. Stress and Hormones, Physiology of Growth, Minor Endocrine glands: Pineal Body, Heart and Kidney.

Desirable to know

Experimental techniques to study various endocrine disorders,

Nice to know: Principles and uses of radioimmunoassay

9. Reproduction :

10 hrs.

Must know

Sex determination and differentiation. Male Reproduction; Functions of Testes, Constituents of Semen, Testicular hormones, Spermatogenesis and regulation. Female Reproduction: Menstrual Cycle: Changes in ovary, uterus, Cervix, vagina and hormonal regulation. Ovulation and Its detection. Fertilization, Implantation, Physiological changes during pregnancy Fetoplacental

Unit, Nutritional needs of mother during pregnancy, Parturition, Lactation, composition of breast milk, Placental and Fetal Circulation, Menopause, Physiology of Newborn. Family planning & welfare: Physiological basis of Contraception, safe period, rhythm and other methods of contraception.

Desirable to know

Disorders of sex differentiation and aberration,

Nice to know: Principles and indications for assisted reproduction

10. Central Nervous System:

32 hrs.

Must know

Organisation of Central Nervous system, Functions and Neuronal organisation at spinal cord level, Reflexes, Sensory receptors, Synapse and synaptic transmission, motor and sensory systems and their lesions, Conduction through myelinated and non myelinated nerve fibres, Reticular system in brain stem, sleep, wakefulness, EEG waves and Physiological changes in EEG, clinical lesions and Experimental sections at spinal cord, brain stem and sub cortical levels, Physiology of Basal Ganglia, Cerebellum, Thalamus, Hypothalamus limbic system, Pre frontal lobe and cerebral cortex, speech and its disorders, Autonomic Nervous system,, Formation, circulation and functions of CSF, Blood Brain Barrier, Central Neuro transmitters. Cerebral blood flow and its measurements. Neuroglia, Physiological basis of CNS Disorders like Alzheimer's disease, Parkinsonism, Syringomyelia and Tabes dorsalis.

Desirable to know

Experimental studies of lesions at spinal cord, brain stem and sub cortical levels.

Yoga and Meditation: Introduction, Yogic Practices, Meditation: Principles and Practice, Physiological effects of Yoga, Yoga in Health diseases.

Nice to know: Principles and uses of CT and MRI Scan

11. Special Senses:

10 hrs.

Must know

- a) Eye: Functional anatomy of Eye, image formation on Retina, Structure of photoreceptors, Electrical activity of photoreceptors, Errors of Refraction, Functions of Aqueous humour, Intraocular tension. Mechanisms of Accommodation Dark adaptation, pupillary reflexes functions of Retina, optic pathway and lesions. Role of visual cortex in

perception. Field of vision. Colour vision, Acuity of vision, Photochemistry of vision, Nutritional deficiency blindness.

- b) Auditory Apparatus : Functional anatomy of Ear, Physics of sound , Role of Tympanic Membrane, Middle ear and cochlea in hearing , Auditory Receptors and Pathway, Deafness and its causes, Tuning fork tests & Interpretation.

Vestibular apparatus: Structure and Functions, Connections and lesions of vestibular apparatus.

- c) Taste and Smell: Modalities, Receptors, pathway, Cortical and limbic areas associated with taste and smell.

Desirable to know: Principles and uses of Audiometry

Nice to know: Visual and auditory evoked potential.

12. Biomedical Waste:

01hr.

Types, Potential Risks and their safe management

Practicals

The following list of practicals are minimum and essential. Additional exercises can be included as and when feasible and required. All the practicals have been categorized as Procedures and Demonstration. The procedures are to be performed by the students during practical classes to acquire skills. Some of these would be included in the practical during University examination. Those categorized as “Demonstrations” are to be shown to students during practical classes. However, these Demonstrations would not be included in the university examinations, but questions based on these would be given in the form of data, charts, problems and case - histories for interpretation by students.

Procedures to be performed by the students:

I. Hematology: Major Experiments

1. RBC count
2. Total WBC Count
3. Differential WBC Count.
4. Absolute Eosinophil Count.

Hematology: Minor Experiments

1. Estimation of Hemoglobin Content of blood.
2. Bleeding Time
3. Clotting Time.

4. Blood Grouping.
5. Determination of blood indices: MCV, MCH, MCHC and Colour Index.

II. Procedures to be performed on human subjects.

1. Mosso's Ergography: at normal condition, after venous occlusion and arterial occlusion.
2. Recording of Arterial Blood Pressure, effect of posture and exercise on it.
3. Stethography: at rest, effect of deglutition, exercise, voluntary hyperventilation and voluntary breath holding.
4. Spirometry: Lung volumes and capacities and FEV1, MVV & Dyspnoeic Index.
5. Visual field by Perimetry.
6. Body composition -BMI (by Quetlet's Index) & Body Fat % by Durenberg's equation, Calculation of BSA and Body temperature (TPR chart).

III. Clinical Examination

1. Clinical Examination of Radial Pulse.
2. Clinical Examination of Cardiovascular system.
3. Clinical Examination of Respiratory system.
4. Clinical Examination of Higher functions.
5. Clinical Examination of Sensory System.
6. Clinical Examination of Motor system including examination of Reflexes.
7. Clinical Examination of Cranial Nerves.

IV. Interpretation of charts, graphs, case histories, Calculations & Demonstrations:

1. Hematology: Hematocrit, (PCV) ESR, Platelet count and Reticulocyte count, osmotic fragility test.
2. Cardiovascular system : ECG Recording in lead II and calculation of Heart rate, PR Interval and Identification of J Point, Identification and Interpretation of graph : JVP
3. Cardiovascular fitness test by 2km walk test or bicycle ergometer or Harvard step test.
4. Nervous system: Autonomic Function Tests.
5. Amphibian Practicals: Muscle - Nerve and heart experiments may be demonstrated if feasible for academic interest only and not for university examination.

6. Respiratory system: Determination of lung volumes and capacities & other lung function tests by computerized spirometry, Flow – Volume loop.
7. Special Senses :
8. Audiometry , Purkinje - Sanson's images, ophthalmoscopy, Retinoscopy,
9. Examination of fundus.
10. CNS: Electroencephalogram.
11. N.M.Physiology: Electromyography.
12. *Renal Physiology : Identification and Functioning of Artificial Kidney*
13. *GIT : Identification and uses of Ryles' Tube*
14. *Interpretation of Investigation reports of Patients.*

Scheme of Examination

Internal Assessment

Total Marks: 80 (Theory: 60 and Practical: 20)

Theory: 60 Marks

There should be regular Formative assessment. Day to day performance should be given greater significance. Minimum of three sessional examinations are to be conducted. The sessional examination preceding the university examination may be similar to the pattern of university examination.

Average of any two best marks obtained in the examinations will be taken into consideration for calculating Internal assessment. 20% weightage will be given to day to day assessment (Performance in Periodic tests, MCQ, diagram training programme & structured viva voce training programme, Participation in Seminars and Research Projects etc). One of the three sessional examinations will be on MCQ. Average marks obtained in two best sessional examinations and marks obtained for day to day assessment will be added and the sum of these two shall be sent to the University.

Practical: 20 Marks

There will be three terminal practical examinations. Average of best two will be reduced to 16 and marks obtained for Practical Records and performance in periodic practical tests will be reduced to 04. One of the three terminal examinations will be OSPE Type. The Internal

Assessment Marks both in theory and practicals obtained by the candidate will be sent to the University at least fifteen days prior to the commencement of Theory Examinations.

The Internal Assessment marks should be displayed on the notice board. The students should be shown their answer scripts. Their signatures have to be taken against the marks obtained. The answer scripts should be stored in the respective department for 3yrs.

University Examination

Eligibility for writing the University examination:

Every candidate should have attendance not less than 75% of the total classes conducted in theory and practical/clinical jointly in the academic 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 III, Section 4, Extraordinary issued on 15th October 2003).

The Principal should notify at the College, the attendance and progress in any subject(s) in theory or practical / clinical in the* first appearance should not be permitted to appear for the examination in that subject(s).*

Criteria for Pass

A student has to secure marks as follows to pass in a subject:

- i) 35% in internal assessment (for eligibility to appear for University examination)
- ii) 50% of total marks for theory with orals (only externals)
- iii) 50% of marks in Practical/Clinical (only externals)
- iv) 50% of aggregate (total of externals and internals)

Distribution of Marks for University Examination

I. Theory Examination

It is of three hundred marks in total, which consist of university theory examinations (Paper I and Paper II, 100 Marks each). 200 Marks.

University Viva Voce examination: 40Marks.

Theory I. A. : 60Marks.

Distribution of Portions for theory Papers will be 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 some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.

Scheme of Marks distribution

Paper - I 100 Marks

Paper- II 100 Marks

Duration of Each Paper will be 03hrs.

The Pattern of Question Paper will be of 03types.

I	Long Essays	02x10 = 20 Marks
II	Short Essays	10x05 = 50 Marks
III	Short Answers	10x03 = 30 Marks

B. Practical:

80 Marks

There shall be two practical sessions, Practical I and II, each carrying 40marks, each practical will be of 2 hrs, duration. The distribution of content and marks for the practical would be:

Practical I A:		20Marks
1. Clinical Examination	-	20 Marks.
2. Procedures on Human Subjects	-	20 Marks.
Practical II:		40 Marks.
3. Hematology (Major)	-	20 Marks.
(Minor)	-	10 Marks.

4. Interpretation of case histories/problems/ charts - 10 Marks.

C. Viva - Voce Examination: 40 Marks.

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

Table 1 - Portions of Paper I - 20 Marks.

Table 2 - Portions of Paper II - 20 Marks.

Recommended Test Books and Reference Books

Deciding which textbook to buy is not an easy task. Choice of a textbook depends on the individual and his or her aptitude. It is desirable, and would certainly be helpful if each student has one textbook out of the recommended list of textbooks. The list of books under the section Reference books are categorized under three levels of difficulty-level-1 being the easiest. The books under level 1 are meant for providing an overall, simple but comprehensive account of physiology. Books at level 2 can be considered as alternative textbooks and some of them are excellent books for further reading. Level 3 books are really meant for purpose of reference during advanced study in any special area of Physiology.

Text Books (Latest Edition)

1. A.K.JAIN (RL), Understanding Medical Physiology; text book for medical students, Jaypee brothers, New Delhi.
2. MAHAPATHRA. Essentials of Medical physiology, Current books international, Calcutta.
3. CHAUDHURI (Sujith K), Concise Medical Physiology, New Central Books, Calcutta.
4. GUYTON (Arthur C), Text of Medical Physiology. Prism Publishers, Bangalore.
5. GANONG (William F), Review of Medical Physiology, Appleton and Lange
6. TORTORA (Gerald J), Principles of Anatomy and Physiology Harper Collins Ref. College Publication.

Reference Books

Level -1

MORAN Campbell E.J. Clinical Physiology, ELBS UK,

Level -2

1. BERNE (Robert M) and levy (Mathew), Physiology, Mosby Publication.
2. SCHMIDT (RF) and THEWS (G), Human Physiology, Springer VERlog, London.

Level -3

1. MOUNTCASTLE (Veernow B), Medical Physiology.
2. PATTON (Harry d), Text book of Physiology.
3. RAINER AND NINDHAERST - Text of Physiology - Springer verlog, London.

Text Books on Practical Physiology (Latest Edition)

1. Ghai., A textbook of Practical Physiology.
2. McLeod, Clinical Examination.
3. Hutchinson & Hunter, Clinical Methods.
4. A.K.Jain - Manual of Practical Physiology.

Topics for group discussion

Gen. Physiology: Transport across cell membrane. Blood: Body Fluid, Erythropoiesis, Morphology and functions of WBCs. GIT: Composition, Functions and Regulation of Secretion of Saliva, gastric juice and pancreatic juice. Motility of gut. Respiratory Physiology: Intrapleural, Intrapulmonary and Transpulmonary pressure changes during respiration, Transport of Oxygen and CO₂ in blood., Regulation of respiration, Hypoxia CVS : Properties of cardiac muscle, Cardiac output, Cardiac Cycle, Regulation of arterial BP and HR. Renal Physiology : Concentration and dilution of Urine. M. N. Physiology: E-C coupling. Endocrine System: Actions and regulation of secretion of GH, Thyroid hormones, Parathormone, Insulin, glucagon, glucocorticoids, mineralocorticoids, Adrenaline and Nor-adrenaline. Reproductive system: Spermatogenesis, Physiology of Menstrual cycle, Contraceptive measures. CNS: Connection and functions of cerebellum, Basal ganglia, Thalamus, hypothalamus and Limbic

system. Special Sense: Visual Pathway, Errors of Refraction, Mechanism of colourvision and hearing.

Topics for Interactive Sessions

Blood: Tests for bleeding disorders. Blood groups ESR, PCV, Blood Indices (Chart and Problem) Acid base balance. GIT: Gastric function tests, GI Hormones. Respiratory Physiology: Lung function tests, Artificial respiration in man. CVS: Tests to evaluate cardiopulmonary fitness. Heart sounds, Arterial pulse J.V.P. (Graph) ECG, (graph) Coronary blood flow, Shock Renal Physiology: Clearance tests (problem), Cystometrogram, Abnormal Urinary bladders, Body temperature regulation. M. N. Physiology: N. M. Junction and Transmission, Types of contraction, Genesis of fatigue. Endocrine System: Effects of abnormal secretions of GH, thyroid hormone, PTH and adrenocortical hormones. (Charts). Reproductive System: Ovulation (Chart). CNS : Receptors, Synapse, Reflex (Chart), Pyramidal and Extrapramidal systems, Effects of sections of spinal cord at various levels (case histories), Effects of lesion in cerebellum / Basal ganglia / Sensory cortex (case histories). Special Sense: Tests for visual acuity, Tests for colour vision, Tests for hearing. Physiology of olfaction and gustation.

TOPICS FOR INTEGRATED TEACHING PROGRAMME

FOR MBBS PHASE I COURSE

Sl. No	Topics	Departments to participate
1	Cell Membrane: Structure (Anat), function(Bioc) and transport across the cell membrane (Phy)	Anatomy, Physiology, & Biochemistry
2	Anaemia: Pathophysiology (Patho), Investigation & treatment (Med) & Public health importance (Comm Med)	Physiology, Biochemistry, Pathology & community Medicine
3	Human Genetics: Anatomic considerations(Anat), applied aspects (Surgery & Paed)	Anatomy, Physiology, Biochemistry, Surgery & Pediatrics.
4	Acid base balance General considerations (Bioc), Acid Base balance (Phys) & disorders & Treatment (Med).	Physiology, Biochemistry, Medicine
5	Acid Peptic disease: Anatomy of stomach(Anat), Functional aspects of stomach (Phy), Pathophysiology of Acid Peptic disease (Path), Medical Management of acid peptic disease (Med), Surgical Management of acid peptic disease (Surg)	Anatomy, Physiology, Pathology, Medicine & Surgery.
6	Liver: Structure of Liver (Anat), functional aspect of liver (Phys), Biochemical aspect of liver (Bioch)	Anatomy, Physiology, Biochemistry.
7	Myocardial infarction: Anatomy of coronary arteries (Ana), physiological aspects of coronary blood flow (Phy), Pathophysiology of CAD (Pathology), Biochemical markers in CAD (Bioch), Medical management of CAD (Med), surgical management of CAD (Surg).	Anatomy, Physiology, Pathology, Biochemistry, Medicine, & Surgery.
8	Parkinsonism: Anatomy of Basal Ganglia (anat), Physiology of BG (Phys), clinical features, investigations & treatment (Med)	Anatomy, Physiology, Medicine.

HUMAN BIOCHEMISTRY

Goals:

The broad goal of teaching of Biochemistry to undergraduates is to develop scientific temper, acquire educational experience for proficiency in profession & promote healthy living.

The knowledge acquired in Biochemistry shall help the student to integrate molecular events with structure and function of the human body in health and disease. To acquire basic practical skills for Biochemical investigation in order to support clinical diagnosis of common disorders. To promote research activities for students and staff.

OBJECTIVES:

At the end of the course, the learner shall be able to

1. Understand, describe and summarize the molecular and functional organization of cells, structure, functional relationship and interrelationships of various biomolecules in health and disease.
2. Summarize the basic and clinical aspects of enzymology with emphasis on diagnostic and therapeutic uses of enzymes.
3. Understand and describe digestion, assimilation of nutrients, associated disorders like obesity, starvation, malnutrition and malabsorption syndrome.
4. Understand, describe and integrate the various metabolic pathways and their regulation.
5. Describe mechanisms involved in water, electrolyte and acid base balance and its disorders.
6. Understand and summarize basic molecular mechanism of organization of genome. Genetic expression and regulation, recombinant DNA technology and genetic engineering and explain the biochemical basis of common inherited disorders in India.
7. Summarize the basic aspects of immunology including body defense mechanism.
8. Biochemical aspects of carcinogenesis and effects of xenobiotics.
9. Basic principles of medical biotechnology and their applications in medicine.
10. Continue to learn recent advances in Biochemistry and apply the same in medical practice.
11. Identify principles of routine and specialized biochemistry, laboratory investigations and techniques, analysis and interpretation of biochemical laboratory techniques.

12. Use basic devices for qualitative and quantitative biochemical investigations.
13. Understand different types of biomedical waste, their potential risks and their management.
14. Explain the biochemical basis of inherited disorders with their associated sequelae.
15. Understand the biochemical basis of environmental health hazards.
16. To inculcate good behavioral skills, soft skills and communication skills.

Skills:

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

1. Make use of conventional techniques and perform relevant biochemical investigations for clinical screening and diagnosis.
2. Analyze and interpret laboratory investigations.
3. Demonstrate skills for solving clinical problems and arrive at final diagnosis using laboratory data.

IMPORTANT INSTRUCTIONS TO STUDENTS:

1. 75% attendance is compulsory.
2. 35% marks has to be obtained in the internal assessment compulsorily to attain eligibility for university examinations.
3. Discipline has to be strictly maintained.
4. Use of mobile phones/electronic devices is strictly prohibited in the lecture halls, practical hall, demonstration room and in the department.
5. Notice board has to be periodically seen for department notices and time tables.
6. Records and practical manuals should be brought for every practical without fail.
7. Records should be complete in every aspect and submitted before each practical session.
8. Records should be neatly maintained.

SAFETY MEASURES TO BE FOLLOWED IN THE UNDERGRADUATE LABORATORY:

1. Careful handling of reagents, especially with corrosives.
2. No mouth pipetting.
3. Careful handling of burner and flame.

4. Test tubes should be facing away while heating.
5. Aprons should be neat and tidy and half sleeves.
6. Working table should be kept clean.
7. Instructions should be followed properly.
8. Students are instructed to wear formal dresses.

Teaching Hours

CHEMICAL STRUCTURE S ARE NOT MANDATORY FOR UNDER GRADUATES

1. Lectures.	120 hours.
2. Tutorials/Small Group Discussion/Problem based learning/open book examination.	20 hours.
3. Seminars / Monthly tests/ Integrated Teaching Programme Internal assessment & Revision classes.	20 hours.
4. Practicals / Demonstrations/Revision practicals.	80 hours (40x2)

Total	240 hours

Distribution of theory classes

1. Introduction & History of Biochemistry.	1 hrs
2. Cell & sub cellular structures.	2 hrs
3. Acids, bases, pH, Buffers, Henderson Hasselbalch equation	1 hrs
4. Radioactive isotopes & their application in Medicine.	1 hrs
5. Enzymes.	8 hrs
6. Vitamins.	9 hrs
7. Bioenergetics & Biological oxidation.	3 hrs
8. Carbohydrate- chemistry, digestion, absorption & metabolism.	14 hrs
9. Lipids- chemistry, digestion, absorption & metabolism	14 hrs
10. Protein- chemistry, digestion, absorption & Metabolism.	18 hrs
11. Integration of metabolism and citric acid cycle.	1 hrs
12. Molecular Biology, Molecular Genetics & Medical Biotechnology	14 hrs
13. Haemoglobin chemistry and metabolism.	4 hrs

14. Organ function tests - LFT, KFT & Thyroid Function tests	3 hrs
15. Acid base balance & its disorders.	3 hrs
16. Water, electrolyte balance & its disorders.	1 hrs
17. Detoxification mechanism and metabolism of xenobiotics, Entoxification	1 hrs
18. Mineral Metabolism.	5 hrs
19. Nutrition & Energy metabolism, Diet planning	5 hrs
20. Biochemistry of Cancer.	1 hrs
21. Biochemistry of AIDS.	1 hrs
22. Tissue proteins in Health & disease.	3 hrs
23. Mechanism of action of peptide and Steroid hormones	1 hrs
24. Biochemical aspects of atherosclerosis & Biochemical markers of MI	1 hrs
25. SI units, quality control.	1 hrs
26. Biomedical waste management.	1 hrs
27. Body Fluids.	1 hrs
28. Environment & Health.	2 hrs

COURSE CONTENTS

Theory

120 hrs

Sl. No	Must Know	Desirable to know	Nice to Know
01	Introduction- Scope of Biochemistry. 1 hrs	History of Biochemistry and medical biotechnology.	
02	Cell and sub cellular structures and its functions 2 hrs i) Cell membrane composition ii) Transport across cell membrane a. Active transport. b. Facilitated diffusion. c. Receptor mediated transport. d. Endocytosis.	Cell receptors	
03	Acids, bases, pH, buffers- buffering capacity, mechanism 1 hrs of action, Henderson Hasselbalch's Equation (without derivation) and its clinical application.		
04	Radioactive isotopes and their application in medicine. 1 hrs i. Radiation, isotopes, half life, units of radio activity. ii. Isotopes in research, diagnosis and treatment,	Methods of study of intermediary metabolism.	Radiation Hazards
05	Enzymes 8 hrs i. Nature of enzymes, Classification, coenzymes, cofactors & activators. ii. Mechanism of action, specificity of enzymes iii. Enzyme Kinetics, physical	Uses of enzymes in clinical laboratory (Urease, uricase, Glucose oxidase peroxidase, Hexokinase, Cholesterol oxidase, lipase, Horse radish peroxidase, ALP,	Uses of Immobilized enzymes.

	<p>factors affecting enzyme action, Km value and its significance (derivation of Km is not required)</p> <p>iv. Enzyme inhibition –irreversible & reversible- competitive, non-competitive, uncompetitive, importance of competitive inhibition. Anti-metabolites and their clinical application.</p> <p>v. Regulation of enzyme activity- Hormonal, Feedback inhibition, covalent modification, allosteric, induction, repression, stabilization & compartmentalization.</p> <p>vi. Clinical enzymology – Enzymes, Isoenzymes and their diagnostic significance (LDH, CPK, AST, ALT, ALP, NTP, GGT, ACP, Cholinesterase, G-6-PD, amylase, lipase)</p> <p>vii. a) Therapeutic uses of enzymes (Asparaginase, Streptokinase, Urokinase, streptodornase, hyaluronidase, pancreatin, papain, alpa – 1 antitrypsin)</p> <p>viii) ELISA & RIA.</p>	<p>Restriction Endonuclease, Reverse transcriptase).</p>	
<p>06</p>	<p>Vitamins 9</p> <p>hrs</p> <p>Classification, Chemical nature (detailed structure is not required), coenzyme forms, biochemical functions, sources, requirement, deficiency manifestations, antagonists and toxicity.</p> <ol style="list-style-type: none"> i. Vit A. ii. Vit D. iii. Vit E and Vit K. iv. Thiamine, Riboflavin. v. Pyridoxine, Pantothenic acid. vi. Niacin, biotin. vii. Folic acid (details of one 	<p>Free radicals, antioxidants,</p>	<p>Nitric oxide &, Nitric oxide synthase complex.</p>

	<p>carbon metabolism is not required</p> <p>viii. Vit B₁₂.</p> <p>ix. Vit C.</p>		
07	<p>Bioenergetics and biological oxidation.</p> <p>3 hrs</p> <p>i. Bioenergetics, redox potential, high energy and low energy compounds, Enzymes involved in ETC.</p> <p>ii. ETC components & arrangement.</p> <p>iii. Mechanism of oxidative phosphorylation.</p> <p>iv. Inhibitors of ETC, Uncouplers</p>	Brown adipose tissue metabolism.	
08	<p>Carbohydrate- chemistry, digestion, absorption and metabolism</p> <p>14 hrs</p> <p>i. Definition, Classification, Biological importance of carbohydrates. Monosaccharides- Classification, importance, Structure and important properties.</p> <p>ii. Disaccharides - Structure and their importance</p> <p>iii. Homopolysaccharides - Structure and their importance</p> <p>iv. Heteropolysaccharides - Structure and their importance</p> <p>v. Digestion & absorption of carbohydrates. Disorders associated with transport of glucose across the cell membrane.</p> <p>vi. Glycolysis – pathway, rate limiting steps & regulation.</p> <p>vii. Glycolysis inhibitors, energetics, fate of pyruvate in aerobic and anaerobic conditions.</p>	Glycosylated Hb & fructosamino albumin.	

	<p>viii. Production of acetyl CoA (PDH complex), Rappaport Leubering cycle and its significance.</p> <p>ix. Gluconeogenesis – pathway, key enzymes, regulation & Cori’s cycle.</p> <p>x. Glylogen synthesis & Glycogen degradation.</p> <p>xi. Regulation of glycogen metabolism in brief & glycogen storage diseases.</p> <p>xii. HMP shunt pathway (second part of pathway is not to be emphasized), NADPH generation, transketolase and its significance, tissue where HMP pathway takes place, G6PD deficiency.</p> <p>xiii. Metabolism of fructose, galactose, uronic acid pathway, inborn errors associated.</p> <p>xiv. Blood glucose levels and its maintenance, mechanism of action of insulin, insulin receptor, insulin resistance, glucagon & growth hormone.</p> <p>xv. Diabetes mellitus, etiology, biochemical basis of symptoms and complications (microalbuminuria).</p> <p>xvi. Glucose tolerance test – different types, precautions, procedure, interpretation.</p>		
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<p>09</p>	<p>Lipids – Chemistry, digestion, absorption & metabolism 14 hrs</p> <p>i. Definition, classification and biological importance, structural and functional aspects of simple lipids.</p> <p>ii. Structural and functional aspects of compound lipids.</p> <p>iii. Derived lipids, Fatty acids - saturated, unsaturated. Steroids and their properties. Eicosanoids.</p> <p>iv. Digestion and absorption of lipids, role of bile salts and disorders.</p> <p>v. β -Oxidation of fatty acids, carnitine & regulation. α and ω oxidation & its importance.</p> <p>vi. Denovo synthesis of fatty acids, regulation, elongation, desaturation.</p> <p>vii. Cholesterol – Chemistry, Synthesis, (up to mevalonate in detail & later on only crucial intermediates), regulation, transport, fate, formation of bile salts, fate of bile salts & other compounds derived from cholesterol (Steroid hormones). Isoprenoid units.</p> <p>viii. Blood levels of cholesterol, plasma lipoproteins, classification, transport, functions and its disorders.</p> <p>ix. Formation and utilization of ketone bodies, ketoacidosis (starvation,</p>	<p>Action of insulin, glucagon, GH, Liver-adipose tissue axis, post prandial and starvation states,</p>	
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	<p>DM).</p> <p>x. Metabolism of adipose tissue, Triacylglycerols & its regulation, hormone sensitive lipase, fatty liver, lipotropic factors.</p> <p>xi. Functions of essential fatty acids and PUFA, prostaglandins, prostacyclins, thromboxanes and leukotrienes and their functions.</p> <p>xii. Phospholipids– formation, degradation & Glycolipids, Sphingolipids inborn errors associated with it.</p>		
10	<p>Chemistry of proteins, digestion, absorption & metabolism.</p> <p>18 hrs</p> <p>i. Amino acids – definition, classification based on structure, nutritional requirement and metabolic fate.</p> <p>ii. Ionic properties of amino acids, isoelectric pH, buffering action of amino acids and proteins.</p> <p>iii. Structural organization of proteins – primary, secondary, tertiary & quaternary with suitable examples, forces involved in stabilization of their structure, biologically active peptides.</p> <p>iv. Classification based on their chemical nature and functions. Properties of proteins-denaturation, coagulation and</p>	<p>Metabolic importance of Glutamic acid, Glutamine, Aspartic acid, asparagine polyamines.</p>	

	<p>flocculation.</p> <p>v. Plasma proteins, separative techniques of plasma proteins, blood levels of plasma proteins. Albumin - functions & clinical aspects.</p> <p>vi. Transport proteins & acute phase proteins.</p> <p>vii. Immunoglobulins – Structure, types and functions, multiple myeloma, Bence Jones proteins.</p> <p>viii. Digestion and absorption of proteins and disorders.</p> <p>ix. General reactions of amino acids – decarboxylation, transamination, deamination, transdeamination.</p> <p>x. Formation of ammonia, urea cycle and disorders.</p> <p>xi. Metabolism and importance of glycine. Inborn errors & formation of creatine.</p> <p>xii. Metabolism and importance of cysteine, methionine & transmethylation reactions.</p> <p>xiii. Urinary sulphur, cystinuria, homocystinuria & glutathione.</p> <p>xiv. Phenylalanine and tyrosine metabolism and its inborn errors.</p> <p>xv. VMA and its importance.</p> <p>xvi. Metabolism of tryptophan (only end products and</p>		
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	<p>PLP dependent reactions.</p> <p>xvii. Xanthuronic acid, Niacin synthesis in brief, serotonin, melatonin, indoxyl, Hartnup's disease.</p> <p>xviii. Importance of branched chain amino acids (metabolic pathway is not necessary), Maple syrup urine disease,</p>		
11	<p>Integration of metabolism and citric acid cycle.</p> <p>1 hrs</p> <p>i. Citric acid cycle, reactions, energetics & regulation.</p> <p>ii. Amphibolic role, anaplerotic reactions & inhibitors</p>	Integration of carbohydrates, lipids and protein metabolism.	
12	<p>Molecular biology, molecular genetics and medical biotechnology.</p> <p>14 hrs</p> <p>i. Structure of Purines, Pyrimidines, Nucleosides Nucleotides, function of nucleotides & biologically important nucleotides.</p> <p>ii. Sources of carbon & nitrogen for Purine synthesis (no detailed steps of synthesis, only crucial intermediates), PRPP synthesis and functions. Degradation of purines. Gout and hyperuricemia. Conversion of ribonucleotides to deoxyribonucleotides.</p> <p>iii. Synthesis of pyrimidine, orotic aciduria (Degradation of pyrimidine is not required, only end products), Salvage pathway of purine and pyrimidine & Lesch Nyhan syndrome.</p> <p>iv. Structure, properties and functions of DNA, different types of DNA,</p>		Hybridoma technology & bioinformatics.

	<p>mitochondrial DNA, Base pairing rule, difference between DNA & RNA.</p> <ul style="list-style-type: none"> v. RNA – types of RNA, their structure and functions. vi. DNA replication, DNA polymerase, regulation, DNA repair mechanism and diseases associated inhibitors of DNA replication. vii. Transcription, RNA polymerase, post transcriptional modification, inhibitors, reverse transcriptase, introns and exons, ribozymes. viii. Genetic code, tRNA and ribosomes. ix. Translation, post translational modification & inhibitors of protein biosynthesis. x. Genome and its organization, Gene expression, regulation of gene expression (lac operon concept), repression, derepression, induction & mutations. xi. Recombinant DNA technology, Restriction endonuclease, Gene library, Gene therapy. xii. DNA hybridization techniques – Southern blot, northern blot, Western blot, PCR, reverse PCR, RFLP, 		
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13	Hemoglobin Chemistry and Metabolism. 4 hrs i. Porphyrins, heme & other heme containing proteins. ii. Biosynthesis of heme, regulation, porphyrias and laboratory diagnosis. iii. Brief chemistry, structure & normal variants of Hb. Degradation of hemoglobin & metabolism of bile pigments. iv. Jaundice - Classification, causes – congenital and acquired, investigation in blood and urine. v. Abnormal hemoglobin, hemoglobinopathies, thalassemia	Anemia.	
14	Organ function tests. 3 hrs i. LFT ii. KFT iii. Thyroid function tests	GFT	
15	Acid base balance and its disorders 3 hrs i. Acids and bases of the body, mechanism of pH regulation, body buffers, Respiratory and renal mechanism. ii. Acidosis, anion gap, alkalosis, assessment of acid base status	ABG analysis and interpretation.	
16	Water and electrolyte balance and its disorders. 1 hr	Water intoxication	
17	Detoxification mechanism and metabolism of xenobiotics, 1 hr		Entoxification.

18	<p>Mineral metabolism. 5 hrs</p> <p>Sources, dietary requirements, absorption, transport, fate, metabolism, functions, excretion, deficiency manifestations of the following.</p> <ol style="list-style-type: none"> i. Calcium, phosphorus ii. Iron, Copper, magnesium iii. Iodine, Fluoride iv. Zinc, manganese, selenium, chromium 		Toxicity of heavy metals – Cadmium, Arsenic, Nickel, Mercury & lead.
19	<p>Nutrition and energy metabolism & Diet planning. 5 hrs</p> <ol style="list-style-type: none"> i. Caloric value of food, RQ, BMR and its clinical significance, specific dynamic action of food, energy allowances based on age, sex and physical activities. ii. Nitrogen balance, protein quality, biological value of protein, nutritional value and protein requirement. iii. Balanced diet, proximate principles of diet and their relative proportions. iv. PEM – Kwashiorkar, Marasmus & Malabsorption syndrome. iv. Biochemistry of starvation, obesity, dietary fibers, 	Diet planning in health and diseases.	TPN (Total parenteral nutrition) Toxic substances in food (natural, additives).
20	<p>Biochemistry of cancer 1 hr</p> <ol style="list-style-type: none"> i. Aetiology – chemical carcinogens, Oncogenic virus, oncogenes, Anti-oncogenes, suppressor genes, Growth factors, tumour markers. 	Apoptosis	

21	Biochemistry of AIDS 1 hr Transmission, natural course of disease, laboratory analysis,		Anti – HIV drugs & prevention.
22	Tissue proteins in Health and disease 3 hrs i. Collagen synthesis, structure, functions and abnormalities. ii. Elastin, Keratin, contractile proteins - Actin, myosin, troponins & neurotransmitters.	Diseases due to abnormal protein structure – Prion's disease, lens proteins (Cataract).	Biochemistry of ageing, Alzheimers disease.
23	Hormones 1 hr i) Mechanism of action of peptide and steroid hormones (insulin, Glucagon, Epinephrine and steroids).	Structure and functions of hormones	
24	Biochemical aspects of atherosclerosis and biochemical markers of MI 1 hr i. Biochemistry of Atherosclerosis, lipid profile, apoproteins, Lp(a) homocysteine & C – reactive protein. ii. Biochemical markers of MI- LDH, CPK–MB, Myoglobin, troponin, SGOT.	Newer cardiac biomarkers.	
25	SI units & Quality control 1 hr i. SI units, Quality control-definition, collection of samples, Transport of samples. Limit of errors allowable in lab.	External Quality control programme	
26	Biomedical waste management 1 hr	Collection, handling, transport and disposal of BMW, functioning of	

		incinerator	
27.	Body Fluids 1 hr Milk,CSF,Amniotic Fluid, Synovial Fluid, Ascitic Fluid		
28.	Environment & Health 2 hrs Introduction, Classification of Environment Environmental Biochemistry, Environmental Pollution- Water Pollution, Air Pollution, Adaptation to an altered environmental temperature- Heat Stress & Cold Stress		

Practicals

PART – I Qualitative Experiments

40 X 2 = 80 Hours

1. Reactions of Glucose and Fructose.
2. Reactions of Lactose, Maltose.
3. Reactions of Sucrose and Starch.
4. Identification of unknown carbohydrate.
5. Precipitation and coagulation reactions of proteins.
6. Colour reactions of proteins: Albumin, casein.
7. Identification of unknown protein.
8. Identification of Biochemically important substances.
9. Normal constituents of urine and physical characteristics.
10. Organic: Urea, Uric Acid and Creatinine.
11. Inorganic: Ca, P, Cl, SO₄, and NH₃.
12. Analysis of abnormal constituents of urine.

PART - II Quantitative Experiments

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 Calcium and interpretation.
5. Estimation of total serum proteins, Albumin and A: G ratio.
6. Estimation of serum creatinine and interpretation.

PART – III Demonstrations

1. Colorimetry.
2. Paper electrophoresis.
3. Paper Chromatography.
4. Ion Selective Electrode (ISE)
5. Glucose tolerance test.
6. Determination of AST (SGOT) and ALT (SGPT) and interpretation.
7. Determination of serum cholesterol (enzymatic method) and interpretation.
8. Determination of glucose, proteins and chloride in CSF and interpretation.
9. Determination of albumin in urine and test for Bence Jones proteins in urine and interpretation.
10. Spot test for PKU, Alkaptonuria and Homocysteinuria.
11. Determination of serum bilirubin and interpretation.
12. Determination of serum amylase and interpretation.
13. Determination of serum uric acid and interpretation.
14. Determination of serum alkaline phosphatase and interpretation.
15. Spotters.
16. Interpretation of charts, graphs and case reports.

SCHEME OF EXAMINATION:

Internal Assessment: Total – 40 (Theory 30, Practical 10 marks)

Theory 30 Marks:

There should be regular formative assessment. Day to day performance should be given greater significance. Minimum of three sessional examinations are to be conducted. The sessional examination preceding the university examination may be similar to the pattern of university examination.

Average of any two best marks obtained in the theory I A examinations will be taken into consideration for calculating Internal assessment. 20% of weightage will be given to day to day

assessment (Performance in monthly tests, participation in seminars and research work, MCQ, Home assignment, structured Viva-voce, Integrated teaching programme, ICMR STS research projects, Quiz competition, UG grand seminar, open book examination, case history, charts, problem based learning, self study, video and photographs etc). Average of best two I A marks and marks obtained for day to day assessment will be added and the sum of these two shall be sent to the University. One of the three sessional examinations will be of MCQ type (preferably II I A)

Practical 10 Marks:

There will be three sessional practical examinations. 20% of weightage will be given to day to day assessment. Average of best two practical I A marks will be reduced to 8 and marks obtained for practical records and performance in periodic practical tests, OSPE will be reduced 02. Average of best two I A marks and marks obtained for day to day assessment will be added and sum of these shall be sent to the university. One of the three sessional examinations will be of OSPE type. (Preferably II I A)

The Internal assessment marks should be displayed on the notice board. The individual student's signature should be taken against the marks obtained.

The Internal assessment marks both theory & practical obtained by the candidates should be sent to the university at least 15 days prior to the commencement of university theory examination.

Student should be shown evaluated answer script. The individual student's signature has to be taken on the answer scripts.

Submission of Practical records for the university examination:

At the time of practical examination each candidate shall submit to the examiners his or her laboratory record, duly certified by the head of the department as a bonafide record of the work done by the candidate

University Examination

Theory: 100 Marks.

There shall be two papers of 50 marks each. The total marks will be 100. The total duration of the paper will be 3 hrs. There shall be 3 types of questions.

Types of question & distribution of marks:

<u>Topics</u>	<u>Type of questions</u>	<u>No of Que & Marks</u>
Paper I	Long essay	1 x 10 = 10
	Short essay	5 x 5 = 25
	Short answer	5 x 3 = 15
Paper II	Long essay	1 x 10 = 10
	Short essay	5 x 5 = 25
	Short answer	5 x 3 = 15

Distribution of topics for each paper & weithage of marks in university examination

Paper I

Topics	Weithage of marks
1. Cell & sub cellular structures	5 Marks
2. Acids, bases, pH, Buffer, Henderson Hasselbalch equation	5 Marks
3. Radioactive isotopes & their application in Medicine	5 Marks
4. Enzymes	10 Marks
5. Vitamins	10 Marks
6. Bioenergetics & Biological oxidation	10 Marks
7. Carbohydrate- chemistry, digestion, absorption & metabolism	10 Marks
8. Lipids- chemistry, digestion, absorption & metabolism	10 Marks
9. Protein- chemistry, digestion, absorption & metabolism	10 Marks

Paper II

Topics	Weithage of marks
1. Integration of metabolism and citric acid cycle	10 Marks
2. Molecular Biology, Molecular Genetics, Medical Biotechnology	10 Marks
3. Haemoglobin chemistry and metabolism	10 Marks

4. Organ function tests - LFT, KFT & Thyroid Function tests	05 Marks
5. Acid base balance & its disorders	10 Marks
6. Water & electrolyte balance & its disorders.	05 Marks
7. Detoxification mechanism, metabolism of xenobiotics, Entoxification	05 Marks
8. Mineral Metabolism	10 Marks
9. Nutrition & Energy metabolism and Diet planning	10 Marks
10. Biochemistry of Cancer	05 Marks
11. Biochemistry of AIDS	05 Marks
12. Tissue proteins in Health & disease.	05 Marks
13. Mechanism of action of Hormones	05 Marks
14. Biochemical aspects of atherosclerosis & Biochemical markers of MI	05 Marks
15. SI units & quality control	05 Marks
16. Biomedical waste management	05 Marks
17. Body Fluids	05 Marks
18. Enviroment & Health	05 Marks

Note:

1. Long essay questions may be asked from topics with weithage of 10 marks.
2. Short essay questions may be asked from any of the topics.
3. Short answer questions may be set from all the chapters (except the chapter on which long essay and short essay questions have been set).
4. **The topic assigned to the different papers are generally evaluated under those sections. However a strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.**

University Practical Examination

Practical: 40 Marks

The practical examination consists of two exercises I & II, each of one hour duration and each exercise carries 20 marks.

Exercise I: 20 Marks

- 1. Quantitative estimation** – Every candidate shall perform one given procedure.
 - a) Principle and procedure for the estimation asked in the question should be written by the candidate in first five minutes. 5 Marks
 - b) After collecting the papers, correct procedure for the estimation is given and practical examination is done. Total marks would be 15 and the distribution of marks would be:
 - i) Results (values), Calculations and reporting. 5 Marks
 - ii) For interpretation of results and application of the estimation. 5 Marks
 - c) Case studies and discussion. 1X5 = 5 Marks.

Exercise II: 20 Marks

- 2. Qualitative analysis** – Every candidate shall perform one given procedure such as – identification of carbohydrates, proteins, substances of Biochemical importance, analysis of normal and abnormal constituents of urine. (Correct procedure for the analysis is given and practical examination is done).
 - i) For selection of appropriate reactions 5 Marks
 - ii) For reasoning of analysis and correct reporting 5 Marks.
 - iii) For interpretation of results 5 Marks.
- 3. Five spotters** including Biochemical techniques, instruments, crystals, biochemical tests and reagents (at the beginning of practical examinations). 1X5 = 5Marks.

Viva-Voce: 20 Marks

The viva voce examination shall carry 20 marks and all the four examiners will conduct the viva examination. The distribution of topics for each examiner is as under.

VIVA-VOCE ASSESSMENT PROGRAMME

Group - I (05)	Cell & subcellular structures, Carbohydrates – Chemistry, Classification, Digestion, Absorption and Metabolism, Biochemistry of cancer & AIDS, Radio isotopes, Integration of Metabolism & citric acid cycle.
Group - II (05)	Proteins-Chemistry, Classification, Digestion, Absorption & Metabolism, Enzymes and Clinical enzymology, Detoxification, SI units & Quality control.
Group - III (05)	Lipids –Chemistry, Classification, Digestion, Absorption, and Metabolism. Nucleic acids, Purine & Pyrimidine metabolism, Molecular biology & Genetics, Biological oxidation, Biochemical aspects of atherosclerosis & markers of MI.
Group-IV (05)	Vitamins, Minerals, Organ function tests (Liver, Kidney, Thyroid), Nutrition and Energy metabolism & Diet planning in health and diseases. Heme metabolism. Water, electrolyte & acid base balance & its disorders. Tissue proteins in health & diseases, Mechanism of action of peptide and steroid hormones, Biomedical waste management, Body Fluids, Environment & Health.

Note: Applied Biochemistry questions may be asked by all the 4 examiners in the respective subject.

Suggested books in Biochemistry: (Latest Edition)

Deciding which text book to buy is not an easy task. Choice of the text book depends on the individual and his or her aptitude. It is desirable, and would certainly be helpful if each student has one text book out of the recommended list of text books

RECOMMENDED BOOKS FOR THEORY

1. Textbook of Biochemistry by Rafi MD.
2. Textbook of Biochemistry by D.M.Vasudevan & Sreekumari.S.
3. Medical Biochemistry by Dinesh Puri.
4. Textbook of Biochemistry by Debajyoti Das
5. Textbook of Biochemistry by U.Satyanarayan & U. Chakrapani.
6. Textbook of Biochemistry Pankaja Naik.

RECOMMENDED BOOKS FOR PRACTICALS

1. Manual of Practical Biochemistry by Rafi MD.
2. Manipal manual of Clinical Biochemistry by Shivanand Nayak.
3. Laboratory Manual in Biochemistry by T.N.Pattabhiraman.

REFERENCE BOOKS

1. Harper's Review of Biochemistry
2. Practical in Clinical Biochemistry by Nath & Nath.

Topics for Group Discussion:

1. Application of radioactive isotopes in Medicine.
2. Diagnostic and Therapeutic uses of enzymes.
3. Antioxidant vitamins.
4. Biochemical investigations in Diabetes Mellitus.
5. Lipid storage disorders.
6. Inborn errors of aminoacid metabolism.
7. Recombinant DNA Technology.
8. Haemoglobinopathies.
9. Thyroid function tests.
10. Kidney function tests.

Topics for Interactive sessions:

1. ABG Analysis and interpretation.
2. Diet planning in health and diseases.
3. Obesity.
4. Biochemistry of ageing.
5. Biochemical markers of Atherosclerosis and MI.
6. Abnormal constituents of urine and interpretation.
7. Glucose tolerance test.
8. Liver function test.
9. Electrophoretic pattern in different diseases.
10. Analytical biochemistry and instrumentation.

TOPICS FOR INTEGRATED TEACHING

Sl. No	Topics	Dept. to organize	Dept. to participate
1	Transport across cell membrane	Biochemistry	Anatomy & Physiology
2	Anaemia	Physiology	Biochemistry & Pathology
3	Jaundice	Biochemistry	Physiology, Pathology, Paediatrics & Medicine
4	Coronary Circulation	Physiology	Anatomy, Biochemistry & Medicine
5	Malnutrition and starvation	Biochemistry	Physiology, Community Medicine & Paediatrics
6	Human genetics	Anatomy	Biochemistry, Physiology & Paediatrics
7	Acid base balance	Biochemistry	Physiology, Medicine & Anaesthesia
8	Thyroid gland	Anatomy	Physiology, Biochemistry, Medicine & Surgery
9	Diabetes mellitus	Biochemistry	Anatomy, Physiology & Medicine
10	Acid peptic disease	Physiology	Biochemistry, Medicine & Surgery

INTRODUCTION TO HUMANITIES AND COMMUNITY MEDICINE

PHASE – I (TERM I & II)

Introduction to Humanities and Community Medicine, which includes Evolution of Medicine, Demography, Medical Sociology, Behavioral Sciences inclusive of Communication Skills and brief introduction to Research methodology and Biostatistics.

Goal:

To prepare undergraduate medical students as a competent Community & Primary Care Physician.

Objectives:

Knowledge:

The student shall be able to:

1. Explain the principles of sociology including demographic population dynamics;
2. Identify social factors related to health, disease and disability in the context of urban and rural societies;
3. The impact of urbanization on health and disease;
4. Observe and interpret the dynamics of community behavior;
5. Describe the elements of normal psychology and social psychology;
6. Observe the principles of practice of medicine in hospital and community setting.
7. Understand the basics of Research in medical field

Skills:

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

1. Principles of practice of medicine in hospital and community settings and familiarization with elementary nursing practices.
2. Art of communication with patients including history taking and medico social work.
3. To formulate a research plan to undertake projects funded by STS ICMR, BLDE University etc.

Teaching of community medicine shall be both theoretical as well as practical. The practical aspects of the training programme shall include visits to the health establishments and to the

community where health intervention programmes are in operation so as to make students understand the role of social, cultural, economic and environmental factors on the health of population in urban & rural communities & also to orient the student about health care facilities available and the services provided by them in the underserved population.

In order to inculcate in the minds of the students the basic concept of community medicine to be introduced in this phase of training, it is suggested that the detailed curriculum drawn shall include at least 30 hours of lectures, demonstrations, seminars etc. together with at least 15 visits of two hours each.

III. COURSE CONTENTS

Lectures

30 Hours

Sl. No.	Topic
1	Introduction to Community Medicine, Evolution of Community Medicine, Indian Systems of Medicine
2	Social factors in health and disease including Behavioural psychology
3	Communication skills & Doctor-patient relationship
4	Demography and family welfare
5	Community Study - Rural, Urban Communities-features, health hazards, the study of family
6	Introduction to Research methodology including Ethics
7	Introduction to Bio-Statistics

Field Visits - 15 (2 hours each)

- **Urban Slum**
- **Community**
- **Primary Health Centre**
- **Hospital**
- **Rural Health Training Centre**
- **Urban Health Training Centre**

SECTION - IV

MEDICAL ETHICS

INTRODUCTION

Medical ethics is a systematic effort to work within the ethos of medicine, which has traditionally been service to sick.

There is now a shift from the traditional individual patient, doctor relationship, and medical care. With the advances in science and technology and the needs of patient, their families and the community, there is an increased concern with the health of society. There is a shift to greater accountability to the society. Doctor and health professionals are confronted with many ethical problems. It is, therefore necessary to be prepared to deal with these problems.

In keeping with its goal to improve quality of education, BLDE University, recommends introduction of medical ethics in the regular teaching of M.B.B.S. course beginning from first year and containing till internship.

OBJECTIVES

The objectives of teaching medical ethics should be to enable to students develop the ability to:

1. Identify underlying ethical issues and problems in medical practice.
2. Consider the alternatives under the given circumstances, and make decisions based on acceptable moral concepts and also traditions practices.

	Course Content	Department	Hours
1	Introduction to Medical Ethics What is Ethics? What are values and norms Relationship between being ethical and human fulfilment? How to form a value system in one's personal and professional life? Hemmans, Heteronomous Ethics and Autonomous Ethics Freedom and Personal Responsibility	Pathology	2
2	Definition of Medical Ethics Difference between medical ethics and bioethics Major Principles of Medical Ethics Beneficence = fraternity Justice = equality	Pathology	2

	Self determination (autonomy) = liberty		
3	Perspectives of Medical Ethics The Hippocratic oath The Declaration of Helsinki The WHO Declaration of Geneva International code of Medical Ethics (1983) Medical Council of India Code of Ethics	Physiology	2
4	Ethics of the Individual The patient as a person The Right to be respected Truth and Confidentiality The Autonomy of decision	Surgery	2
	The concept of disease, health and healing The Right to health Ethics of Behaviour modification The Physician Patient relationship Organ donation	Community Medicine	2
5	The Ethics of Human life What is human life? Criteria for distinguishing the human and the non-human Reasons for respecting human life The beginning of human life Conception, Contraception Abortion Prenatal sex-determination In vitro Fertilisation (IVF) Artificial Insemination by Husband (AIFI) Artificial insemination by Donor (AID) Surrogate motherhood Semen Intrafallopian Transfer (SIFT) Gamete Intrafallopian Transfer (GIFT) Zygote Intrafallopian Transfer (ZIFT) Genetic Engineering	OBG	6
6	The Family and Society in Medical		

	Ethics The Ethics of human sexuality Family Planning perspectives Prolongation of life Advanced life directives — The Living Will Euthanasia Cancer and Terminal Care	Medical Education Department	6
7	Death and Dying Use of life-support systems Death awareness The moment of death Prolongation of life Ordinary and extraordinary life support Advanced life directives Euthanasia — passive and active Suicide — the ethical outlook The right to die with dignity	Anaesthesia	4
8	Professional Ethics Code of conduct Contract and confidentiality Charging of fees, Fee-splitting Prescription of drugs Over-investigating the patient Low cost drugs, vitamins and tonics Allocation of resources in health care	Surgery	4
9	Research Ethics Animal and experimental research Human experimentation Human volunteer research Informed Consent, Drug trails	Pharmacology	4
10	Ethical work-up of cases Gathering all scientific factors Gathering all human factors Gathering all value factors Identifying areas of value conflict setting of priorities Working out criteria towards decisions	All clinical departments	6
		Total hours	40

SECTION - V

ANNEXURE - I

Different Methods Recommended for Internal Assessment by MCI

The Medical Council of India has given some examples of methods for internal assessment of student, which may be followed by the colleges.

They are:

1. Credit for preparation and presentation of seminars by students
2. Preparation of clinical case for presentation.
3. Clinical case study / problems solving exercises.
4. Participation in project for health care in the community
5. Proficiency in conducting a small research project or assignment.
6. Multiple choice questions (MCQ) test after completion of a chapter / system.

Each item shall be objectively assessed and recorded. Some of the items can be assigned as homework/vacation work.

ANNEXURE - II

Coordinated Programme in Theory for MBBS Phase – I of One Year Course in Anatomy, Physiology and Biochemistry

I term

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 Sub-cellular Components Biophysical Principles PH, buffers Biochemistry of nucleic acids	
2	Osteology Myology Arthrology	Haematology Muscle physiology	Classification sources & functions of proteins, carbohydrate &	Anatomy+ Physiology+ Biochemistry+ Pathology

			lipids	
3 & 4	Heart, Blood vessels, Lungs Pleura Systemic embryology	Cardiovascular System Respiratory System	Plasma proteins Protein synthesis Diagnostic Enzymology	
5 & 6	Abdomen, Digestive And Genitourinary Organswith Systemic embryology	Digestive system, secretion and motility	Digestive enzymes Vitamins, Digestion and absorption of food	

II term

Month	Anatomy	Physiology	Biochemistry	Integrated Teaching
	Pelvis	Renal and reproductive Physiology	Liver function, detoxification, renal function, gastric function	
7 & 8	Neuro anatomy Special senses Neural development	Nervous system Special senses Autonomic Nervous System Endocrine Glands	Metabolism of carbohydrates, Amino acids, Protein, 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 Emotion, behaviors	Neurotransmitter, Radio Isotopes, Biological, Oxidation, Electron transfer cycle	CSF Anatomy+ Physiology+ Biochemistry

Coordinated Programme for Dissection / Practical / Demonstration

I term

Month	Anatomy	Physiology	Biochemistry
1	Upper limb dissection Prosected part, Histology tissues Muscles, Bone marrow	Osmotic effect Osmotic hemolysis of RBC, ESR. Principles of hemocytometry	Viscosity, Principles of colourimetry PH – meter Spectometry Sp. Gravity of body fluids
2	Lower limb dissection Prosected part Histology – bone connection Tissue Embryology	Heamatology experiments Muscle experiments	Biochemistry test for Carbohydrate, Proteins, Fats, Minerals.
3	Thorax Abdomen Embryology model	Spirometry Stethography Artificial respiration FEV, Breath sounds	

II term

Month	Anatomy	Physiology	Biochemistry
5 & 6	Thorax Abdomen Pelvis Embryology model	Arterial pulse Venous pulse Blood Pressure, ECG (Demon) Echocardiography (Demon) Stress test Heart sounds	Urine examination Liver function test Renal clearance test
7 & 8	Head and Neck	Clinical examination of : <ul style="list-style-type: none"> • Cranial nerves • Sensory function • Motor function 	Glucose Tolerance Test; Blood Glucose Estimation Chemistry of food Chemistry of milk
9 & 10	Brain	Examination of higher functions reflexes.	CSF Analysis

Urine: Physical and Chemical

Estimation of Glucose in blood and urine G.T.T

ANNEXURE - III

**List of Topics for Integrated Teaching Programme
During MBBS Phase – I course**

Sl. No.	Topics	Department to organize	Departments to participate
1	<i>Human Genetics:</i> Anatomic considerations (Anat), applied aspects (Surgery & Paed)	Anatomy	Anatomy, Physiology, Biochemistry, Surgery & Pediatrics.
2	<i>Acid Peptic disease:</i> Anatomy of stomach (Anat), Functional aspects of stomach (Phy), Pathophysiology of Acid Peptic disease (Path), Medical Management of acid peptic disease (Med), Surgical Management of acid peptic disease (Surg)	Anatomy	Anatomy, Physiology, Pathology, Medicine & Surgery.
3	<i>Liver:</i> Structure of Liver (Anat), functional aspect of liver (Phys), Biochemical aspect of liver (Bioch)	Anatomy	Anatomy, Physiology, Biochemistry.
4	<i>Parkinsonism:</i> Anatomy of Basal Ganglia (anat), Physiology of BG (Phys), clinical features, investigations & treatment (Med)	Anatomy	Anatomy, Physiology, Medicine.
5	<i>Uterus:</i> Anatomy of Uterus (Ana), Physiological changes (Phy), Applied aspects (OBG)	Anatomy	Anatomy, Physiology, OBG
6	<i>Inguinal Hernia:</i> Anatomy of hernia (Ana), Surgical aspects (Sur)	Anatomy	Anatomy, Surgery
7	<i>Thyroid Gland:</i> Anatomy of Thyroid Gland (Ana), Synthesis of thyroid Hormones (Phy), Medical Management of Thyroid disorders (Med), Surgical Management of Thyroid disorders (Sur)	Anatomy	Anatomy, Physiology, Medicine, Surgery
8	Joints	Anatomy	Anatomy, Orthopaedic, Radiology & Physiotherapy

**TOPICS FOR INTEGRATED TEACHING PROGRAMME
FOR MBBS PHASE I COURSE**

Sl. No	Topics	Departments to participate
1	<i>Cell Membrane:</i> Structure (Anat), function (Bioc) and transport across the cell membrane (Phy)	Anatomy, Physiology, & Biochemistry
2	<i>Anaemia:</i> Pathophysiology (Patho), Investigation & treatment (Med) & Public health importance (Comm Med)	Physiology, Biochemistry, Pathology & community Medicine
3	<i>Human Genetics:</i> Anatomic considerations (Anat), applied aspects (Surgery & Paed)	Anatomy, Physiology, Biochemistry, Surgery & Pediatrics.
4	<i>Acid base balance</i> General considerations (Bioc), Acid Base balance (Phys) & disorders & Treatment (Med).	Physiology, Biochemistry, Medicine
5	<i>Acid Peptic disease:</i> Anatomy of stomach (Anat), Functional aspects of stomach (Phy), Pathophysiology of Acid Peptic disease (Path), Medical Management of acid peptic disease (Med), Surgical Management of acid peptic disease (Surg)	Anatomy, Physiology, Pathology, Medicine & Surgery.
6	<i>Liver:</i> Structure of Liver (Anat), functional aspect of liver (Phys), Biochemical aspect of liver (Bioch)	Anatomy, Physiology, Biochemistry.
7	<i>Myocardial infarction:</i> Anatomy of coronary arteries (Ana), physiological aspects of coronary blood flow (Phy), Pathophysiology of CAD (Pathology), Biochemical markers in CAD (Bioch), Medical management of CAD (Med), surgical management of CAD (Surg).	Anatomy, Physiology, Pathology, Biochemistry, Medicine, & Surgery.
8	<i>Parkinsonism:</i> Anatomy of Basal Ganglia (anat), Physiology of BG (Phys), clinical features, investigations & treatment (Med)	Anatomy, Physiology, Medicine.

TOPICS FOR INTEGRATED TEACHING

Sl. No	Topics	Dept. to organize	Dept. to participate
1	Transport across cell membrane	Biochemistry	Anatomy & Physiology
2	Anaemia	Physiology	Biochemistry & Pathology
3	Jaundice	Biochemistry	Physiology, Pathology, Paediatrics & Medicine
4	Coronary Circulation	Physiology	Anatomy, Biochemistry & Medicine
5	Malnutrition and starvation	Biochemistry	Physiology, Community Medicine & Paediatrics
6	Human genetics	Anatomy	Biochemistry, Physiology & Paediatrics
7	Acid base balance	Biochemistry	Physiology, Medicine & Anaesthesia
8	Thyroid gland	Anatomy	Physiology, Biochemistry, Medicine & Surgery
9	Diabetes mellitus	Biochemistry	Anatomy, Physiology & Medicine
10	Acid peptic disease	Physiology	Biochemistry, Medicine & Surgery

ANNEXURE - IV
CATEGORIES OF BIO-MEDICAL WASTE
SCHEDULE-I
(See Rule 5)

**Waste Category No.	Waste Category ** Type	Treatment & Disposal ** Options
Category No.1	<u>Human Anatomical Waste</u> (human tissues, organs body parts)	Incineration ^o / deep burial*
Category No.2	<u>Animal waste</u> (animal tissues, organs, body parts, carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals, colleges discharge from hospitals, animal houses)	Incineratin ^o / deep burial*
Category No.3	<u>Microbiology & biotechnology Waste</u> (wastes from laboratory cultures, stocks or specimens of micro-organisms live or attenuated vaccines human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures.)	Local autoclaving/micro-waving/incineration ^o
Category No.4	<u>Waste sharps</u> (needles, syringes, scalpels, blades, glass etc., that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection (Chemical treatment ^{oo} /auto- claving / micro-waving and mutilation / shredding ^{aa}
Category No.5	<u>Discarded Medicines and Cytotoxic drugs</u> (waste comprising of outdated, contaminated and discarded medicines)	Incineration ^o /destruction and drugs disposal in secured landfills
Category No.6	<u>**Soiled Waste</u> (items contaminated with blood and body fluids including cotton, dressings, soiled plaster casts, liners, beddings, other material contaminated with blood)	Incineration ^o autoclaving/micro-waving
Category No.7	<u>Solid Waste</u> (waste generated from disposable items other than the waste**sharps such as tubings, catheters, intravenous sets, etc.)	Disinfection by chemical treatment ^{oo} autoclaving/micro-waving and mutilation/shredding ^{aa}

Category No.8	<u>Liquid Waste</u> (waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection by chemical treatment ^{oo} and discharge into drains
Category No.9	<u>Incineration Ash</u> (ash from incineration of any bio-medical waste)	Disposal in municipal landfill
Category No. 10	<u>Chemical Waste</u> (chemicals used in production of biologicals, chemicals used in disinfection as insecticides etc.,)	Chemical treatment ^{oo} and discharge into drains for liquids and secured landfill for solids

** As per Bio-Medical Waste (Management & Handling) (Second Amendment) Rules, 2000, dated 2nd June, 2000.

^{oo} Chemicals treatment using at least 1% hypochlorite solution or any other equivalent chemical reagent. It must be ensured that chemical treatment ensures disinfection.

^{aa} Mutilation/shredding must be such so as to prevent unauthorized reuse.

^o There will be no chemical pretreatment before incineration. Chlorinated plastics shall not be incinerated.

* Deep burial shall be an option available only in towns with population less than five lakhs and in rural areas.

COLOUR CODING AND TYPE OF CONTAINER FOR DISPOSAL OF BIO-MEDICAL WASTES

SCHEDULE – II
(See Rule 5)

Colour Coding	Type of Container	Waste Category	Treatment Options as per Schedule-I
Yellow	Plastic bag	Cat. 1, Cat.2, Cat.3, Cat.6.	Incineration/deep burial
Red	Disinfected container/plastic bag	Cat.3, Cat.6, Cat.7.	Autoclaving/Micro-waving chemical Treatment.
Blue/White Translucent	Plastic bag/puncture proof container	Cat.4, Cat.7.	Auto claving/Micro-waving/Chemical Treatment and destruction/shredding
Black	Plastic Bag	Cat.5, and Cat.9 and Cat.10 (solid)	Disposal in secured landfill

Notes:

1. Colour coding of waste categories with multiple treatment options as defined in Schedule-I shall be selected depending on treatment option chosen, which shall be as specified in Schedule-I
2. Waste collection bags for waste types needing incineration shall not be made of chlorinated plastics.
3. Categories 8 and 10 (liquid) do not require containers/bags.
4. Categories 3 if disinfected locally need not be put in containers/bags.