

KERALA UNIVERSITY OF HEALTH SCIENCES

THRISSUR – 680 596, KERALA



REGULATIONS, CURRICULUM, AND SYLLABUS OF

**UNDER GRADUATE MEDICAL
COURSE (MBBS)**

CONTENTS

1. Introduction

2. General considerations and Teaching Approach.

3. Objectives.

- 3.1 National Goal
- 3.2 Institutional Goals.

4. Regulations

- 4.1 Eligibility Criteria
- 4.2 Admission process
- 4.3 Registration
- 4.4 Migration and Transfer
- 4.5 Attendance

5. Training.

- 5.1 Training period and time distribution
- 5.2 Phase distribution and timing of examination
- 5.3 Clinical posting schedule in various departments.

6. Examination regulations

- 6.1 Essentialities to qualify for examinations.
- 6.2 Internal Assessment
- 6.3 Eligibility to appear for University Examination
- 6.4 University examination.
- 6.5 Criteria for Pass
- 6.6 Declaration of Class
- 6.7 Distribution of marks

7. Internship

- 7.1 General
- 7.2 Specific Objectives
- 7.3 Time allocation
- 7.4 Compulsory and elective postings
- 7.5 Other details
- 7.6 Assessment for internship
- 7.7 Full registration

8. Appendix

- 8.1 List of comprehensive skills.
- 8.2 Time table for various semesters.
- 8.3 Assessment of internship.

9. Course Syllabus.

- 9.1 Human Anatomy
- 9.2 Biochemistry
- 9.3 Human Physiology including Bio-physics
- 9.4 Forensic Medicine & Toxicology.
- 9.5 Microbiology.
- 9.6 Pathology.
- 9.7 Pharmacology.
- 9.8 Community Medicine.
- 9.9 Ophthalmology.
- 9.10 Otorhinolaryngology.
- 9.11 Medicine & Allied Specialities.
- 9.12 Surgery and allied specialities.
- 9.13 Orthopaedics
- 9.14 Physical Medicine & Rehabilitation
- 9.15 Radiotherapy
- 9.16 Anaesthesiology
- 9.17 Paediatrics
- 9.18 Obstetrics & Gynaecology.

1. INTRODUCTION

MCI regulations on graduate medical education in 1997 envisage a change in the pattern of medical education. The basic concept is to increase vertical integration of medical curriculum. A reduction of six months is made for the I MBBS course, increasing the training period of the II and III MBBS. The overall course duration is the same, but is reorganized into nine semesters of six months each. The reduction of six months of the I MBBS is meant to reduce the quantum of teaching of preclinical subjects to the medical students and to give time during the later years for revising the preclinical subjects with relevance to the clinical teachings. Organisation of teaching of clinical subjects should be done concentrating on vertical integration, incorporating the teaching staff of preclinical and paraclinical subjects also. A new pattern is designed for the internal assessment and University examinations. Paediatrics is being separated from Medicine and organized as a separate examination in Final MBBS Part II. The calendar for the new batch is made ready on the starting of the course. House surgeons postings are reorganized according to the IMC norms with suitable modifications.

2. GENERAL CONSIDERATIONS AND TEACHING APPROACH

Graduate medical curriculum is oriented towards training students to undertake the responsibilities of a physician of first contact who is capable of looking after the preventive, promotive, curative and rehabilitative aspects of medicine.

With the wide range of career opportunities available today, a graduate has a wide choice of career opportunities. Training though broad based and flexible should aim to provide an educational experience of the essentials required for health care in our country. Training should be able to meet internationally acceptable standards.

To undertake the responsibilities of service situation which is a changing condition and of various types, it is essential to provide adequate placement training tailored to the needs of such services as to enable the graduates to become effective instruments of implementation of those requirements. To avail of opportunities and be able to conduct professional requirements, the graduate shall endeavour to have acquired basic training in different aspects of medical care.

The importance of the community aspects of health care and of rural health care services is to be recognized. This aspect of education and training of graduates should be adequately recognized in the prescribed curriculum. Its importance has been systematically upgraded over the past years and adequate exposure to such experiences should be available through out all the three phases of education and training. This has to be further emphasized and intensified by providing exposure to field practice areas and training during the internship period. The aim of the period of rural training during internship is to enable the fresh graduate to function efficiently under such settings.

The educational experience should emphasize health and community orientation instead of only disease and hospital orientation or being concentrated on curative aspects. As such, all the basic concepts of modern scientific medical education are to be adequately dealt with.

There must be enough experiences to be provided for self-learning. The methods and techniques that would ensure this must become a part of teaching – learning process

The medical graduate of modern scientific medicine shall endeavor to become capable of functioning independently in both urban and rural environment. He/ She endeavor to give emphasis on fundamental aspects of the subjects taught and on common problems of health and diseases avoiding unnecessary details of specialization.

The importance of social factors in relation to the problems of health and diseases should receive proper emphasis throughout the course and to achieve this purpose the educational process should also be community based than only hospital based. The importance of population control and family welfare planning should be emphasized throughout the period of training with the importance of health and development duly emphasized.

Adequate emphasis is to be placed on cultivating logical and scientific habits of thought, clarity of expression, independence of judgement and ability to collect and analyze information and to correlate them.

The educational process should be placed in a historic background as an evolving process and not merely as an acquisition of a large number of disjointed facts without a proper perspective. The history of medicine with reference to the evolution of medical knowledge both in this country and the rest of the world should form a part of this process. Lectures alone are generally not adequate as a method of training and are a poor means of transferring /acquiring information and even less effective at skill development and in generating the appropriate attitudes. Every effort should be made to encourage the use of active methods related to demonstrations and on first-hand experience. Students will be encouraged to learn in small groups through peer interactions, so as to gain maximal experience through contacts with patients and the communities in which they live. While the curriculum objectives often refer to areas of knowledge or science, they are best taught in a setting of clinical relevance and hands on experience for students who assimilate and make this knowledge a part of their own working skills.

The graduate medical education in clinical subjects should be based primarily on outpatient teaching emergency departments and within the community including peripheral health care institutions. The outpatient departments should be suitably planned to provide training to graduates in small groups.

Clinics should be organized in small groups of preferably not more than 10 students so that a teacher can give personal attention to each student with a view to improve his skill and competence in handling of the patient.

Proper records of the work should be maintained which will form the basis of the student's internal assessment and should be available to the inspectors at the time of inspection of the college by the Medical Council of India.

Maximal efforts have to be made to encourage 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. Every attempt should be made to de-emphasize

compartmentalization of disciplines so as to achieve both horizontal and vertical integration in different phases.

Every attempt is to be made to encourage students to participate in group discussions and seminars to enable them to develop personality, character, expression and other facilities which are necessary for a medical graduate to function either in solo practice or as a team leader when he begins his independent career. A discussion group should not have more than 20 students.

Faculty members should avail of modern educational technology while teaching the students and to attain this objective, Medical Education Units/ Departments should be established in all medical colleges for faculty development and providing learning resource material to teachers.

To derive maximum advantage out of this revised curriculum, the vacation period to students in one calendar year should not exceed one month, during 4 ½ years Bachelor of Medicine and Bachelor of Surgery (MBBS) Course.

In order to implement the revised curriculum in toto, State Governments and Institutional Bodies must ensure that adequate financial and technical inputs are provided.

HISTORY OF MEDICINE - The student will be given an outline on “*HISTORY OF MEDICINE*”: This will be taught in an integrated manner by subject specialists and will be coordinated by the Medical Education Unit of The College.

All medical institutions should have curriculum committee which would plan curricula and instructional method which will be regularly updated

Integration of information and communication technology (ICT) in learning process will be implemented

3.OBJECTIVES OF MEDICAL GRADUATE TRAINING PROGRAMME

3.1 National Goals

At the end of undergraduate programme, the medical student shall endeavor to 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, fulfil 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.

3.2 Institutional Goals

In consonance with the national goals each medical institution should evolve institutional goals to define the kind of trained manpower (or professionals) they intend to produce. The undergraduate students coming out of a medical institute should:

- a. Be competent in diagnosis and management of common health problems of the 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 rationale for different therapeutic modalities, be familiar with the administration of the “essential drugs” and their common side effects;
- d. Be able to appreciate the socio-psychological, cultural, economic and environmental factors affecting health and develop human attitude towards the patients in 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 Programmes including practical aspects of the following:
 - 1. Family Welfare and Maternal and Child Health(MCH),
 - 2. Sanitation and water supply,
 - 3. Prevention and control of communicable and non-communicable diseases,
 - 4. Immunization,
 - 5. Health Education,
 - 6. Indian Public Health Standard (IPHS) of health at various level of service delivery, medical waste disposal
 - 7. Organisational & Institutional arrangements.
- g. Acquire basic management skills in the area of human resources, materials and resource management related to health care delivery; General and Hospital Management, principal inventory skills and counselling.
- 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;

- j. Be competent to work in a variety of health care settings;
- k. Have personal characteristics and attitudes required for professional life such as personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals.

4. REGULATIONS

4.1 Eligibility Criteria

No candidate shall be allowed to be admitted to the medical curriculum of first Bachelor of Surgery (MBBS) course until:

- a. He/She has completed the age of 17 years on or before the 31st of December of the year commencing the prescribed academic session of the said course.
- b. He/ She has passed qualifying examination as under:

The higher Secondary Examination or the Indian School Certificate Examination which is equivalent to 10+2 Higher Secondary Examination after a period of 12 years study, the last two years of study comprising of Physics, Chemistry, Biology/Biotechnology with English with 50% marks for physics, chemistry and biology together and 50% in biology separately . In respect of candidates belong to Scheduled Castes, Schedules Tribes or Other Backward Classes the marks obtained in Physics, Chemistry and Biology taken together in qualifying examination be 40% instead of 50% as above.

Any other examination which, in scope and standard is found to be equivalent to the intermediate science examination of an Indian University/ Board, taking Physics, Chemistry and Biology including practical test in each of these subjects and English

- c. The selection of students for the Under Graduate course shall be made based strictly on merit as decided by the Entrance Examination conducted by the competent authority approved by the Government of Kerala/Kerala University of Health Sciences and as per guidelines of the Medical Council of India (M. C. I.).

4.2 Admission process

The admission shall be completed by each Medical college/Institution as per the statutory time schedule for admissions and in no case any admission will be made in the MBBS course after 30th of September.

The Universities and other authorities concerned shall organize admission process in such a way that teaching in first semester starts by 1st of August each year.

There shall be no admission of students in respect of any academic session beyond 30th September under any circumstance. The University shall not register any students admitted beyond the said date.

The Medical Council of India may direct, that any student identified as having obtained admission after the last date of closure of admission be discharged from the course of study, or any Medical qualification granted to such a student shall not be a recognized qualification for the purpose of the Indian Medical Council Act, 1956. The Institution which grants admission to any students after the last date specified from the same shall also be liable to face such action as may be prescribed by MCI including surrender of seats equivalent to the extent of such admission made from its sanctioned intake capacity for the succeeding academic year.

4.3 Registration

A candidate on admission to the MBBS course shall apply to the University for Registration

By making a formal application in the prescribed format.

Original mark lists of qualifying examination.

Transfer certificate from the previous institution.

Allotment letter from the competent authority who conducted the Entrance Examination/ allotment letter from the Principal in the case of NRI candidates.

Equivalency and migration certificate wherever needed.

Original SSLC/equivalent certificate.

Document for sponsorship of the student, employment certificate and copy of passport of the sponsor in case of NRI candidates.

The fees prescribed for the registration.

4.4 Migration and Transfer

No migration or transfer will be allowed during the entire course of study and internship.

4.5 Attendance

Minimum 80% of attendance separately in clinics/practicals and theory is the criteria for appearing for University examination. Condonation for 10% in the attendance once in the entire course period can be granted by the Head of the Institution.

5 TRAINING

5.1 Training Period and Time Distribution

The admission should be organized in such a way that teaching in first semester starts by August 1 each year.

(1) Every student shall undergo a period of certified study extending over 4 ½ academic years divided into 9 semesters (i.e. of 6 months each) from the date of commencement of his study for the subjects comprising the medical curriculum to the date of completion of examination and followed by one year compulsory rotating internship. Each semester will consist of approximately 120 teaching days of 8 hours each college working time, including one hour of lunch. The nomenclature of semester system will be uniformly followed in place of years as they are nomenclatured now.

(2) The Period of 4 ½ years is divided into three phases as follows:-

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

b. Phase-II (3 Semesters) -consisting of para-clinical/clinical subjects. During this phase teaching of para-clinical and clinical subjects shall be done concurrently. The para-clinical subjects shall consist of Pathology, Pharmacology, Microbiology, Forensic Medicine including Toxicology and part of Community Medicine. The clinical subjects shall consist of all those detailed below in Phase III. Out of the time for Para-clinical teaching approximately equal time to be allotted to Pathology, Pharmacology, Microbiology and Forensic Medicine and Community Medicine combined (1/3 Forensic Medicine and 2/3 Community Medicine.

c. Phase-III(Continuation of study of clinical subjects for seven semesters after passing Phase-I)

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

Besides clinical posting as per schedule mentioned herewith, rest of the teaching hours be divided for didactic lectures, demonstrations, seminars, group discussions, etc, in various subjects. The time distribution shall be as given in subject wise syllabus.

The Medicine and its allied specialities training will include General Medicine, Paediatrics, Tuberculosis and Chest, Skin and Sexually Transmitted Diseases, Psychiatry, Radio-Diagnosis, Infectious Diseases etc. The Surgery and its allied specialities training will include General Surgery, Orthopaedic Surgery including Physio-therapy and Rehabilitation, Ophthalmology, Otorhinolaryngology, Anaesthesia, Dentistry, Radio-therapy etc. The Obstetrics and Gynaecology training will include family medicine, family welfare planning etc.

(3) The first 2 semesters (approximately 240 teaching days) shall be occupied in the Phase I (Pre-clinical) subjects and introduction to a broader understanding of the perspectives of medical education leading to delivery of health care. No student shall be permitted to join the Phase II (Para-clinical/clinical) group of subjects until he has passed in all the Phase I (Pre-clinical) subjects.

(4) After passing pre-clinical subjects, 1½ year (3 semesters) shall be devoted to para-clinical subjects. Phase II will be devoted to para-clinical and clinical subjects, along with clinical postings. During clinical phase (Phase III) pre-clinical and para-clinical teaching will be integrated into the teaching of clinical subjects where relevant.

(5) Didactic lectures should not exceed one third of the time schedule, two third schedule should include practicals, clinicals or/and group discussions. Learning process should include living experiences, problem oriented approach, case studies and community health care activities.

5.2 Phase Distribution and Timing of Examinations

The nine semesters of six months each are distributed to three phases as detailed below:

Phase	Semesters		Examination		
Phase I	Semesters	I and II	I MBBS Biochemistry	Anatomy,	Physiology,
Phase II	Semesters	III, IV and V	II MBBS, Pharmacology, Pathology, Microbiology, Forensic Medicine		
Phase III	Semesters	VI and VII	III MBBS Part I Ophthalmology, Otolaryngology, Community Medicine		
	Semesters	VIII and IX	III MBBS Part II General Medicine, General Surgery, Obstetrics and Gynaecology and Paediatrics		

Note:

- Passing the Ist professional examination (I MBBS) is compulsory before proceeding to Phase II training
- A student, who fails in the IInd professional examination, shall not be allowed to appear in IIIrd professional Part I examination unless he passes all subjects of II nd professional examination.
- Passing in IIIrd professional (Part I) examination is not compulsory before entering into semesters VIII and IX training, however passing of IIIrd professional (Part I) is compulsory for appearing for IIIrd professional (Part II) examination.

5.3 Clinical posting schedule in various departments

SUBJECT	SEMESTERS									TOTAL WEEKS
	III	IV	V	EXAM	VI	VII	EXAM	VIII	IX	
***Gen Medicine	6		4	X	4		X	8	4	26
Paediatrics		2		X	4		X		4	10
TB & chest		2		X			X			2
Skin & VD		2	4	X			X			6
Psychiatry		2		X			X			2
*Radiology		2		X			X			2
****Gen. Surgery	6		4	X	4		X	8	4	26
**Orthopaedics		2		X	4		X		4	10
Ophthalmology			4	X		6	X			10
Otolaryngology			4	X		4	X			8
*****O&G		4	4	X	4		X	8	4	24
Com. Medicine	6			X		6	X			12
Casualty		2		X			X			2
Dentistry				X		2	X			2
TOTAL IN WEEKS	18	18	24	8	20	18	8	24	20	142

Clinical methods in Medicine and Surgery for whole class will be for 2 weeks each respectively at the start of 3rd semester.

* This posting includes training in Radio diagnosis and Radiotherapy where existent.

** This posting includes exposure to Rehabilitation and Physiotherapy.

*** This posting includes exposure to laboratory medicine and infectious diseases.

**** This posting includes exposure to dressing and Anaesthesia.

******* This includes maternity training and Family medicine and in Family Welfare Planning.**

Note:

To include the clinical pathology and anaesthesia posting in the general clinical posting local adjustments may be done at the level of individual Institutions in accordance with the availability of slots in various departments. E.g. Anaesthesia posting for two weeks may be given from the dept. of surgery during VIth or VIIIth semester in consensus with respective Dept. Heads. Clinical pathology for two weeks may be taken from the dept. willing to provide slots/can be arranged by reallocating the timings of theory classes. Institutions should adhere to the above academic pattern. However, in case of semesters already commenced, internal adjustments may be done by individual Institutions between 3rd, 4th and 5th semesters to ensure compliance to this finalized pattern.

CLINICAL POSTINGS SUBJECT WISE

Semester	Semester	Semester	Semester	Semester	Semester	Semester
III	IV	V	VI	VII	VIII	IX
18 weeks	18 weeks	24 weeks	20 weeks	18 weeks	24weeks	20 weeks
General Medicine 6 weeks	Paediatrics: 2 weeks	General Medicine 4 weeks	General Medicine 4 weeks	Ophthalmology 6 weeks	General Medicine 8 weeks	General Medicine 4 weeks
	TB and Chest Diseases 2 weeks	Skin & STD 4 weeks	Paediatrics: 4 weeks	ENT : 4 weeks	General Surgery – 8 weeks	
General Surgery – 6 weeks	Skin & STD: 2 weeks	General Surgery 4 weeks	General Surgery 4 weeks	Dentistry 2 weeks		Paediatrics: 4 weeks
				Community Medicine 6 weeks		General Surgery 4 weeks

Community Medicine 6 weeks	Psychiatry 2 weeks	Ophthalmology 4 weeks	Orthopaedics 4 weeks		O&G & FWP – 8 weeks	Orthopaedics 4 weeks
	Radiology- 2 weeks	ENT : 4 weeks	O&G & FWP 4 weeks			
	Orthopaedics 2 weeks	O&G & FWP 4 weeks				
	O&G & FWP 4 weeks					
	Casualty 2 weeks					
		University Exam		University Exam		University Exam

CLINICAL POSTINGS OF MBBS STUDENTS

Semester	Semester	Semester	Semester	Semester	Semester	Semester
III	IV	V	VI	VII	VIII	IX
18 weeks	18 weeks	24 weeks	20 weeks	18 weeks	24 weeks	20 weeks
General Medicine 6 weeks	Paediatrics 2 weeks	General Medicine 4 weeks	General Medicine 4 weeks	Ophthalmology 6 weeks	General Medicine 8 weeks	General Medicine 4 weeks
	TB and Chest D – 2 weeks	Skin & STD 4 weeks:	Paediatrics 4 weeks	Otorhinolaryn gology 4 weeks	General Surgery 8 weeks	Paediatrics 4 weeks
			General Surgery	Dentistry		

			4 weeks	2 weeks		
	Skin & STD: 2 weeks	General Surgery 4 weeks	Orthopaedics 4 weeks	Community Medicine 6 weeks		General Surgery 4 weeks
General Surgery 6 weeks	Psychiatry 2 weeks	Ophthalmology 4 weeks				Orthopaedics 4 weeks
Community Medicine 6 weeks	Radiology 2 weeks	OtorhinoLaryngology 4 weeks	O&G & FP 4 weeks		O&G & FWP 8 weeks	O&G & FWP 4 weeks
	Orthopaedics 2 weeks	O&G & FWP 4 weeks				
	O&G & F 4 weeks					
	Casualty 2 weeks					
		Final Internal Assessment Examination		Final Internal Assessment Examination		Final Internal Assessment Examination
		University Examination II MBBS		University Examination Final MBBS Part-I		University Examination Final MBBS Part-II

6 EXAMINATION REGULATIONS

6.1 Essentialities for qualifying to appear in professional examinations.

The performance in essential components of training are to be assessed, based on:

6.2 Internal Assessment

It shall be based on periodical assessment, evaluation of student assignment, preparation for seminar, clinical case presentation etc. Regular examinations shall be conducted throughout the course. The question of number of examinations is left to the institution. Day to day assessment should be given importance during internal assessment, Weightage for internal assessment shall be 20% of the total marks in each subject. The candidate must secure at least 35% marks of the total marks fixed for internal assessment in a particular subject in order to be eligible to appear in the final University examination of that subject. Internal Assessment should be a continuous evaluation and *CLASS AVERAGE* marks should not exceed 75% of maximum marks. Marks of minimum of three exams in the subject should be taken for calculation of internal assessment.

6.3 Eligibility to appear for the University Examination

A student who has secured 35% marks for internal assessment is qualified to appear for University examination provided he/she satisfies that percentage of attendance requirement as said already.

6.4 University Examinations.

The examinations are to be designed with a view to ascertain whether the candidate has acquired the necessary knowledge, minimum skills, as detailed in Appendix A along with clear concepts of the fundamentals which are necessary for him to carry out his day to day work competently. Evaluation will be carried out on an objective basis. An examination calendar should be prepared with designated dates for all internal and University Examinations by the Institutional Curriculum Committee every year. (Pattern given as Appendix D)

The theory question papers will be designed in such a way that the questions include structured essays, short answer questions. The theory papers in pre and paraclinical subjects will give due weightage to the applied aspects and clinical subjects will include questions based on basic sciences also. The present pattern of question papers is provided along with subject wise syllabus given in part II.

The Practical / clinical examination will be conducted in the laboratories or hospital wards. Objective will be to assess proficiency in skills, conduct of experiment, interpretation of data and logical conclusion. Clinical cases should preferably include common diseases the student is likely to come across in practice. Rare cases/obscure syndromes, long cases of neurology etc. shall not be kept for the final examination. Emphasis should be on candidate's capability in eliciting physical signs and their interpretation. Practical examination should be objective and should test skills and ability to interpret the results. Structured evaluation should be done. OSCE (Objective Structured Clinical Evaluation) should be incorporated in the practical examinations. Viva/ oral includes evaluation of management approach and handling of emergencies.

Candidate's skill in interpretation of common investigative data, x-rays, identification of specimens, ECG, etc. also is to be evaluated.

6.5 Criteria for Pass

In each of the subjects, a candidate must obtain 50% in aggregate for a pass. This 50% in aggregate includes:-

A separate minimum of 50% in aggregate for theory including viva. (University theory** + Viva + Internal Assessment) & a separate minimum of 50% in aggregate for Practicals /clinics (University Practicals /clinics+ Internal assessment)

**** However, a separate minimum of 50% marks in University theory is mandatory for a pass. (This regulation will be effective for all students admitted from the academic year 2012-2013 onwards.)**

(See Table for the distribution of marks in various disciplines)

Example: Anatomy

Total 200 marks				
Theory	Paper I	50 Marks	120	140
	Paper II	50 Marks		
	Int. Asses	20 Marks		
Viva			20	
Practicals	Uni. Exam	40 Marks	60	
	Int. Asses	20 Marks		
Total				200

Out of a total of 140 marks for theory, a student should secure a minimum of 70 marks in aggregate (with 50 marks in University theory alone) and out of 60 marks for practicals, a separate minimum of 30 is essential for a pass.

Grace marks up to a maximum of five in total may be awarded for an examination at the discretion of the passing board for a student to pass one subject (theory only) provided the student has passed in all other subjects. Grace marks will not be awarded to change internal assessment marks.

A candidate who fails in any one subject but obtains pass marks in another subject of the same examination shall be exempted from re-examination in the subject, which the candidate has passed.

The Supplementary examination for First Professional MBBS Examination may be conducted within 6 months so that the students who pass will continue as an additional batch of students and the failed students will have to appear in the subsequent year

6.6 Declaration of Class

Candidates who pass the whole examination shall be ranked in the order of proficiency as determined by the total marks obtained by each in both parts and shall be arranged in three classes .

- i. Distinction - 75% and above
- ii First Class - 65% and above, less than 75%
- iii Second Class - 50% and above, less than 65%

All candidates who fail in the first attempt in any subject and pass subsequently shall not be ranked in distinction or first class.

6.7 Distribution of Marks

Sl. No.	Subject	Theory Paper I	Theory Paper II	IA	Oral	Total T+IA+O	Practical	IA	Total	Subject total
1.	Anatomy	50	50	20	20	140	40	20	60	200
2.	Physiology	50	50	20	20	140	40	20	60	200
3	Biochemistry	50	50	20	20	140	40	20	60	200
4.	Pharmacology	40	40	15	15	110	25	15	40	150
5.	Pathology	40	40	15	15	110	25	15	40	150
6	Microbiology	40	40	15	15	110	25	15	40	150
7.	Forensic Medicine	40		10	10	60	30	10	40	100
8.	Ophthalmology	40		10	10	60	30	10	40	100
9.	Otorhinolaryngology	40		10	10	60	30	10	40	100
10	CommunityMedicine	60	60	20	10	150	30	20	50	200
11	General Medicine	60	60	30	20	170	100	30	130	300
12	General Surgery	60	60	30	20	170	100	30	130	300
13	Obstetrics & Gynaecology	40	40	20	30	130	50	20	70	200
14	Pediatrics	40		10	10	60	30	10	40	100

Note:

Internal Assessment examinations may be conducted as per the discretion of the departments (Minimum of one examination per semester) without violating MCI norms.

Internal assessment in Medicine and surgery will include sub specialities

7 INTERNSHIP

7.1 General

Internship is a phase of training wherein a graduate is expected to learn methods/ modalities for actual practice of medical and health care and acquire skills under supervision so that he/she may become capable of functioning independently.

7.2 Specific objectives

At the end of the internship training, the student shall be able to:

- a) diagnose clinically common disease conditions encountered in practice and make timely decision for referral to higher level;
- b) Use discreetly the essential drugs, infusions, blood or its substitutes and laboratory services;
- c) Manage all type of emergencies – medical, surgical, obstetric, neonatal and paediatric, by rendering first level care;
- d) Demonstrate skills in monitoring of the National Health Programmes and schemes, oriented to provide preventive and promotive health care services to the community;
- e) Develop leadership qualities to function effectively as a leader of the health team organized to deliver the health and family welfare service in the existing socio-economic, political and cultural environment;
- f) Render services to chronically sick and disabled (both physical and mental) and to communicate effectively with patient and the community
- g) Computer knowledge, data entry in connection with admission and discharge of patients.

7.3 Time allocation

Time allocation to each discipline is approximate and shall be guided more specifically by the actual experience obtained. Thus a student serving in a District or Taluk hospital emergency room may well accumulate skills in Surgery, Orthopaedics, Medicine, Obstetrics and Gynaecology and Paediatrics during even a single night on duty. Responsible authorities from the Medical College shall adjust the intern's opportunities to practice skills in patient care in rough approximation of the time allocation suggested.

7.4 Compulsory and elective postings

Community Medicine	2 months
Medicine including 15 days of Psychiatry	2 months
Surgery including 15 days Anaesthesia	2 months
Obst./Gynae. including Family Welfare Planning	2 months
Paediatrics	1 month
Orthopaedics including PMR	1 month
ENT	15 days
Ophthalmology	15 days
Casualty	15 days
Elective Posting (1x15 days)	15 days

Subjects for Elective posting will be as follows:

- i. Dermatology and Sexually Transmitted Diseases
- ii. Tuberculosis and Respiratory Diseases
- iii. Radio-Diagnosis
- iv. Forensic Medicine
- v. Blood Bank
- vi. Psychiatry

Note: Structure internship with college assessment at the end of the internship.

Foot Note : The Principal Regulations namely, “Regulations on Graduate Medical Education, 1997” were published in Part – III, Section (4) of the Gazette of India vide Medical Council of India Notification dated the 4th March, 1997 and amended vide Council notification dated 29.05.1999, 02.07.2002, 30.09.2003, 16.10.2003 & 01.03.2004

7.5 Other details

(a) Every candidate will be required after passing the final MBBS examination to undergo compulsory rotational internship to the satisfaction of the College authorities and University for a period of 12 months so as to be eligible for the award of the degree of Bachelor of Medicine and Bachelor of Surgery (MBBS) and full registration.

(c) The University shall issue a provisional MBBS pass certificate on passing the final examination.

(d) The State Medical Council will grant provisional registration to the candidate on production of the provisional MBBS pass certificate. The provisional registration will be for a period of one year. In the event of shortage or unsatisfactory work, the period of provisional registration and the compulsory rotating internship may be suitably extended by the appropriate authorities.

(e) The intern shall be entrusted with clinical responsibilities under direct supervision of a senior medical officer. They shall not be working independently.

(f) Interns will not issue a medical certificate or a death certificate or a medicolegal document under their signature.

(g) In recognition of the importance of hands-on experience, full responsibility for patient care and skill acquisition, internship should be increasingly scheduled to utilize clinical facilities available in District specific experiences and skills as listed in major areas:

Provided that where an intern is posted to District/Sub Divisional Hospital for training, there shall be a committee consisting of representatives of the College/ University, the State Government and the District administration, who shall regulate the training of such trainee;

Provided further that for such trainee, a certificate of satisfactory completion of training shall be obtained from the relevant administrative authorities which shall be countersigned by the Principal/Dean of the College.

(h) Adjustment to enable a candidate to obtain training in elective clinical subjects may be made.

(i) Each medical college shall establish links with one entire district extending out-reach activities. Similarly, Re-orientation of Medical Education (ROME) scheme may be suitably modified to assure teaching activities at each level of District health system which will be coordinated by Dean of the Medical College;

(j) Out of one year, 6 months shall be devoted to learning tertiary care being rendered in teaching hospital/district hospital suitably staffed with well qualified staff, 3 months of secondary care in a small District or Taluk Hospital/ Community Health Centre and 3 months in Primary Health care out of which 2 months should be in Primary Health Centre with full attention to the implementation of National Health Programme at the community level. One month of primary care training maybe in the form of perceptorship with a practicing family physician or voluntary agency or other primary health care provider.

(k) One year's approved service in the Armed Forces Medical Services, after passing the final MBBS examination shall be considered as equivalent to the pre-registration training detailed above; such training shall, as far as possible, be at the Base/General Hospital.

7.6 Assessment for internship

(a) The intern shall maintain a record of work in the form of a log book, which is to be verified and certified by the medical officer under whom he works. This shall cover all aspects including the essential skills - covering all Taxonomic Domains, Ethical skills, Communication skills and computer skills in connection with data entry regarding admissions and discharges - that would have to be learned during Internship training. An assessment and grading of these skills would be made by the concerned authorities in each department periodically. Assessment and grading of the computer skills should be made by the HODs and entered in the log book. Performance of the skills should be taught, supervised and certified by a member of the teaching staff.

Apart from scrutiny of the record of work, assessment and evaluation of training shall be undertaken by an objective approach using situation tests in knowledge, skills and attitude during and at the end of training. Based on the record of work and date of evaluation, the Dean/Principal shall issue certificate of satisfactory completion of training, following which the University shall award the MBBS degree or declare him eligible for it.

- (b) Satisfactory completion shall be determined on the basis of the following score ranging from 0 to 5.

0 – Poor, 1 –Average, 2 –Satisfactory, 3 – Good, 4 – Very Good and 5 – Excellent

- i. Proficiency of knowledge required for each case.
- ii. The Competency in skills expected to manage each case: namely
 - a. Competency for performance of self-performance
 - b. Of having assisted in procedures
 - c. Of having observed procedures.
- iii. Responsibility, punctuality, work up of case, involvement in treatment, follow-up reports
- iv. Capacity to work in a team (behaviour with colleagues, nursing staff and relationship with paramedicals)
- v. Initiative, participation in discussions, research aptitude.

A score of less than 3 any of above items will represent unsatisfactory completion of internship.

7.7 Full registration

Full registration shall only be given by the State Medical Council/Medical Council of India on the award of the MBBS degree by the University or its declaration that the candidate is eligible for it.

8. APPENDIX

8.1 List of comprehensive skills

I. Clinical Evaluation:

- (a) To be able to take a proper and detailed history. Comprehensive
- (b) To perform a complete and thorough physical examination and elicit clinical signs.
- (c) To be able to properly use the Stethoscope, Blood Pressure Apparatus, Auroscope, Thermometer, Nasal Speculum, Tongue Depressor, Weighing Scales, Vaginal Speculum etc;
- (d) To be able to perform internal examination – Per Rectum (PR), Per Vaginum (PV) etc;
- (e) To arrive at a proper provisional clinical diagnosis.

II. Bed Side Diagnostic Tests:

- (a) To do and interpret Haemoglobin (HB), Total Count (TC), Erythrocyte Sedimentation Rate (ESR), Blood smear for parasites, Urine examination – albumin/ sugar/ ketone/ microscopic;
- (b) Stool exam for ova and cysts;
- (c) Gram staining and Ziehl-Nielsen staining for AFB;
- (d) To do skin smear for lepra bacilli;
- (e) To do and examine a wet film vaginal smear for trichomonas;
- (f) To do skin scraping and Potassium Hydroxide (KOH) stain for fungus infections;
- (g) To perform and read Mantoux Test.

III. Ability to carry out Procedures:

- (a) To conduct CPR (Cardiopulmonary resuscitation) and First aid in newborns, children and adults;
- (b) To give Subcutaneous (SC)/ Intramuscular (IM)/ Intravenous (IV) injections and start Intravenous (IV) infusions;
- (c) To pass a nasogastric tube and give gastric lavage;
- (d) To administer oxygen – by mask/ catheter;
- (e) To administer enema
- (f) To pass a urinary catheter – male and female;
- (g) To insert flatus tube;
- (h) To do pleural tap, ascitic tap & lumbar puncture;
- (i) Insert intercostals tube to relieve tension pneumothorax;
- (j) To relieve cardiac tamponade;
- (k) To control external haemorrhage.

IV. Anaesthetic Procedures:

- (a) Administer local anaesthesia and nerve block;
- (b) Be able to secure airway patency and administer Oxygen by Ambu bag;

V. Surgical Procedures:

- (a) To apply splints, bandages and Plaster of Paris (POP) slabs;
- (b) To do incision and drainage of abscesses;
- (c) To perform the management and suturing of superficial wounds;
- (d) To carry on minor surgical procedures, e.g, excision of small cysts and nodules, circumcision, reduction of paraphimosis, debridement of wounds etc;
- (e) To perform vasectomy;
- (f) To manage anal fissures and give injections for piles.

VI. Mechanical Procedures:

- (a) To perform thorough antenatal examination and identify high risk pregnancies;
- (b) To conduct normal delivery;
- (c) To apply low forceps and perform and suture episiotomies;
- (d) To insert and remove IUDs and perform tubectomy.

VII. Paediatrics:

- (a) To assess new born and recognize abnormalities and intra uterine retardation;
- (b) To conduct immunization;
- (c) To teach infant feeding to mothers;
- (d) To monitor growth by the use of “road to health chart” and to recognize development retardation;
- (e) To assess dehydration and prepare and administer Oral Rehydration Therapy (ORT);
- (f) To recognize acute respiratory infection clinically.

VII. ENT Procedures:

- (a) To perform nasal packing of epistaxis;
- (b) To perform tracheostomy;

IX. Ophthalmic Procedures.

- (a) To evert eye-lids;
- (b) To give Subconjunctival injection;
- (c) To perform epilation of eye-lashes;
- (d) To measure the refractive error and advise correctional glasses;
- (e) To perform nasolacrimal duct syringing for patency.

X. Dental Procedures.

- (a) To perform dental extraction.

XI. Community Health.

- (a) To be able to supervise and motivate community and para-professionals for corporate efforts for the health care;
- (b) To be able to carry on managerial responsibilities; e.g. Management of stores, indenting and stock keeping and accounting;
- (c) Planning and management of health camps;
- (d) Implementation of national health programmes;
- (e) To effect proper sanitation measures in the community; e.g. disposal of infected garbage and chlorination of drinking water;
- (f) To identify and institute control measures for epidemics including its proper data collecting and reporting.

XII. Forensic Medicine including Toxicology.

- (a) To be able to carry on proper medicolegal examination and documentation of injury and age reports;
- (b) To be able to conduct examination for sexual offences and intoxications;
- (c) To be able to preserve relevant ancillary materials for medicolegal examination;
- (d) To be able to identify important post-mortem findings in common un-natural deaths;

XIII. Management of Emergencies.

- (a) To manage acute anaphylactic shock;
- (b) To manage peripheral vascular failure and shock;
- (c) To manage acute pulmonary oedema and left ventricular failure;
- (d) Emergency management of drowning, poisoning and seizures;
- (e) Emergency management of bronchial asthma and status asthmatics;
- (f) Emergency management of hyperpyrexia;
- (g) Emergency management of comatose patients regarding airways, positioning – prevention of aspiration and injuries;
- (h) Assess and administer emergency management of burns

8.2 Time tables for various semesters**First and second semesters -240 working teaching days****Semester 1 Time table**

Day	8am - 9 am	9 am -10 am	10 am - 1 p.m	1p.m- to 2 p.m	2 p.m - 4 p.m.
Monday	Biochemistry	Physiology (9-11 a.m)	Anatomy dissection	Lunch	Practicals – PHY/BIO/HIST
Tuesday	Physiology	Biochemistry	Anatomy dissection		Practicals – PHY/BIO/HIST
Wednesday	Anatomy	Physiology	Anatomy dissection		Practicals – PHY/BIO/HIST
Thursday	Physiology	Biochemistry	Anatomy dissection		Practicals – PHY/BIO/HIST
Friday	Biochemistry	Anatomy	Anatomy dissection (10a.m-12p.m)		Physiology
Saturday	Anatomy	Physiology	Community medicine		ANA/BIO/PHY

Semester II Time table

Day	8am - 9 am	9 am -10 am	10 am - 12 noon	12 noon - to 1 p.m	1 p.m - 4 p.m.
Monday	Anatomy	Biochemistry	Practicals PHY/BIO/HIST	Lunch	Anatomy dissection
Tuesday	Physiology	Anatomy	Practicals PHY/BIO/HIST		Anatomy dissection
Wednesday	Biochemistry	Physiology	Practicals PHY/BIO/HIST		Anatomy dissection
Thursday	Physiology	Biochemistry	Practicals PHY/BIO/HIST		Anatomy dissection
Friday	Anatomy	Biochemistry	Physiology		Anatomy dissection(2-4p.m)
Saturday	Biochemistry	Anatomy	Physiology		PHY/ANA/BIO/PHY

Third Semester classes: 18 weeks

Day	8am - 9 am	9 am -12 noon	12 noon - 1 p.m	1- 2 p.m	2 p.m - 4 p.m.
Monday	Paraclinical lectures	Clinical posting	Paraclinical lectures	Lunch	Practicals Para clinical
Tuesday	Paraclinical lectures	Clinical posting	Paraclinical lectures		Practicals Para clinical
Wednesday	Paraclinical lectures	Clinical posting	Paraclinical lectures		Practicals Para clinical
Thursday	Paraclinical lectures	Clinical posting	Paraclinical lectures		Practicals Para clinical
Friday	Paraclinical lectures	Clinical posting	Paraclinical lectures		Practicals Para clinical
Saturday	Paraclinical lectures	Clinical posting	Paraclinical lectures		Practicals Para clinical

Fourth and fifth Semester classes: 42 weeks

Day	8am - 9 am	9 am -12 noon	12 noon - 1 p.m	1- 2 p.m	2 p.m - 4 p.m.
Monday	Lectures in clinical subjects	Clinical posting	Lectures in Paraclinical subjects	Lunch	Practicals Para clinical
Tuesday	Lectures in clinical subjects	Clinical posting	Lectures in Paraclinical subjects		Practicals Para clinical
Wednesday	Lectures in clinical subjects	Clinical posting	Lectures in Paraclinical subjects		Practicals Para clinical
Thursday	Lectures in clinical subjects	Clinical posting	Lectures in Paraclinical subjects		Practicals Para clinical
Friday	Lectures in clinical subjects	Clinical posting	Lectures in Paraclinical subjects		Practicals Para clinical
Saturday	Lectures in clinical subjects	Clinical posting	Lectures in Paraclinical subjects		Practicals Para clinical

Sixth, Seventh, Eighth & Ninth Semester classes 82 weeks

Day	8am - 9 am	9 am -12 noon	12 noon - 1 p.m	1- 2 p.m	2 p.m - 4 p.m.
Monday	Lectures in clinical subjects	Clinical posting	Lectures in Clinical subjects	Lunch	Practicals/Demonstrations in Clinical Subjects
Tuesday	Lectures in clinical subjects	Clinical posting	Lectures in Clinical subjects		Practicals/Demonstrations in Clinical Subjects
Wednesday	Lectures in clinical subjects	Clinical posting	Lectures in Clinical subjects		Practicals/Demonstrations in Clinical Subjects

Thursday	Lectures in clinical subjects	Clinical posting	Lectures in Clinical subjects		Practicals/Demonstrations in Clinical Subjects
Friday	Lectures in clinical subjects	Clinical posting	Lectures in Clinical subjects		Practicals/Demonstrations in Clinical Subjects
Saturday	Lectures in clinical subjects	Clinical posting	Lectures in Clinical subjects		Practicals/Demonstrations in Clinical Subjects

Note: These are suggested time tables. Adjustments where required, depending upon the availability of time and facility, are made. (*Institutional adjustments*)

8.3 Assessment of internship

Name:

Date of Posting: From _____ To _____

Grading:

(0 – Poor, 1 – Average, 2 – Satisfactory, 3 – Good, 4 – Very Good, 5 – Excellent)

Sl no	CRITERIA	GRADING					
General							
1.	Knowledge	0	1	2	3	4	5
2.	Competency and skill (Self competence, observing procedures) assisting procedures,	0	1	2	3	4	5
3.	Responsibility, punctuality, work involvement in treatment, follow up	0	1	2	3	4	5
4.	Capability to work in a team	0	1	2	3	4	5
5.	Initiative, research participation in discussion,	0	1	2	3	4	5
6.	Number of topics presented	0	1	2	3	4	5
7.	Number of seminars attended	0	1	2	3	4	5
8.	Proficiency score (Points given outstanding during the posting) performance	0	1	2	3	4	5

Specific							
1.	Diagnosis	0	1	2	3	4	5
2.	Resuscitation of critically ill	0	1	2	3	4	5
3.	Monitoring patients with serious illness	0	1	2	3	4	5
4.	First line management of acute illness	0	1	2	3	4	5
5.	Performing Procedures (venisection, tracheostomy, intubation, catheterisation, LP, liver biopsy, pleural aspiration etc)	0	1	2	3	4	5

FINAL GRADE:

Sl no	Grading obtained	Grade awarded
1.	0-10	Poor
2.	11-21	Average
3.	22-32	Satisfactory
4.	33-43	Good
5.	44-54	Very Good
6.	55-65	Excellent

APPENDIX E**TIME SCHEDULE FOR COMPLETION OF THE ADMISSION PROCESS FOR FIRST MBBS COURSE**

Schedule for Admission	Seats filled up by Central Government through all India Entrance Examination	Seats filled up by the State Govts/Instt.
Conduct of Entrance Examination	Month of May	Month of May
Declaration of Result of Qualifying Exam./Entrance Exam.	By 5th June	By 15th June
Ist round of counselling/admission	To be over by 30th June	To be over by 25th July

Last date for joining the allotted college and course	Within 15 days from the date of allotment of seats @@	31st July
2nd round of counselling for allotment of seats from waiting list	To be over by 8th August	Upto 28th August
Last date for joining for candidates allotted seats in 2nd round of counselling from the waiting list	Within 15 days from the date of allotment of seats. (seats vacant after 22nd August will be surrendered back to the States / Colleges)	
Commencement of academic session	1st of August	
Last date upto which students can be admitted against vacancies arising due to any reason	30th September	

Note: @@ Head of the College should intimate the vacancies existing after the last date of joining the course by the candidate concerned in respect of the All India Quota of seats to the DGHS within seven days and latest by 23rd of July.

9 COURSE - SYLLABUS

9.1 HUMAN ANATOMY

(I) GOAL

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

(II) OBEJECTIVE

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

(A) *Knowledge*

- a) Comprehend the normal disposition, clinically relevant interrelationships, functional and cross sectional anatomy of the various structures in the body.
- b) Identify the microscopic structure and correlate elementary ultra-structure of various organs and tissues and correlate the structure with the functions as a prerequisite for understanding the altered state in various disease processes.

- c) Comprehend the basic structure and connections of the central nervous system and analyse the integrative and regulative functions of the organs and systems. He/She shall be able to explain the developmental basis of the major variations and abnormalities.
- d) Demonstrate knowledge of the basic principles and sequential development of the organs and systems; recognize the critical stages of development and the effects of common teratogen, genetic mutations and environmental hazards. He /She shall able to explain the developmental basis of the major variations and abnormalities.

(B) Skills

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

- (a) Identify and locate all the structures of the body and mark the topography of the living anatomy
- (b) Identify the organs and tissues under the microscope
- (c) Understand the principles of Karyotyping and identify the gross congenital anomalies.
- (d) Understand principles of newer imaging techniques and interpretation of Computerized Tomography (CT) Scan sonogram etc.
- (e) Understand clinical basis of some common clinical procedures i.e. intramuscular and intravenous injection, lumbar puncture and kidney biopsy etc.

(C) Integration

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

(III) DETAILED SYLLABUS-DETAILS OF THE COURSE

Duration of the Course

Semesters	: 2
Total number of hours	: 650
Lectures	: 89
Seminars	: 42
Practicals	: 519

Innovation session (projects, structured discussion, integrated teaching, formative evaluation and revision) Part of practicals:

DETAILS OF LECTURES

1. General Anatomy

Epithelium: Classification, simple and compound epithelium, glandular and sensory epithelium 2hr
Connective tissue: Cells, matrix

: 2hr

Cartilage: Classification, structure, cells and matrix

: 1hr

Bone: Types, types of epiphysis, microscopy. Ossification in brief, blood supply

: 2hr

Joints: Classification and structure of synovial joint (Details of joints-to be taught in Orthopaedics)

: 1hr

Vascular tissue: Elastic artery, medium sized artery, large vein, medium sized vein: 1hr

Lymphatic tissue: Gen. features, lymph node- structure and function, spleen, structure and circulation, Tonsil, Thymus	: 1hr
Muscular tissue: Structure of Skeletal, Smooth and cardiac Muscles	: 1hr
Skin: Structure of thin and thick skin	: 1hr
Nervous tissue: Neurons, Neuroglia, peripheral nerve structure optic nerve structure Schwann cells, myelination myelinated nerve fibre, Ganglia	: 2hr

2. General Embryology

Oogenesis, Ovarian Cycle	: 1hr
Menstrual cycle	: 1hr
Male reproductive system	
Spermatogenesis	: 1hr
Fertilization, Implantation, assisted reproductive techniques	: 1hr
Bilaminar embryo	: 1hr
Trilaminar embryo	: 1hr
Intraembryonic mesoderm and folding of embryo	: 2hr
Formation and circulation of placenta	: 1hr
Foetal membranes	: 1hr
Twining and teratology (Structure of Umbilical cord and placenta to be taught along with General Embryology)	:1hr
(X-rays and surface marking of each region to be taken after the dissection of the corresponding region is completed)	:4hr

Upper Limb

Brachial plexus	: 1hr
Mammary gland	: 1hr
Shoulder joint	: 1hr
Palmar space	: 1hr

Seminars (Give more importance to applied Anatomy)	: 8hr
Radio-Ulnar joints	: 1hr
Axilla and Axillary artery	: 1hr
Venous and lymphatic drainage of upper limb	: 1hr
Brachial artery	: 1hr
Anastomoses around elbow joint	: 1hr
Radial nerve, Ulnar nerve, Median nerve	: 1hr
Retinacula	: 1hr
Elbow joint, wrist joint, Ist carpometacarpal Joint (X-rays to be demonstrated)	: 1hr

Lower Limb	: 4hrs
Hip joint	: 1hr
Arches of foot	
Knee joint	: 1hr
Development of Limbs, Dermatomes of Upper and Lower Limbs	: 1hr

Seminars (Give more importance to applied Anatomy)	: 6hr
Venous and lymphatic drainage of lower limb	: 1hr
Sub talar joint, inversion and eversion	: 1hr
Femoral triangle, Adductor canal	: 1hr

Obturator nerve	: 1hr
Femoral artery and nerve	: 1hr
Ankle joint, Popliteal fossa	: 1hr
Thorax	: 9hr
Thoracic wall (including movements)	:1hr
Pleura	: 1hr
Lungs including development of lung	: 1hr
Pericardium	: 1hr
Blood supply of heart	: 1hr
Arterial arches	: 1hr
Foetal circulation	: 1hr
Development of heart	: 2hr
Seminars (Give more importance to applied Anatomy)	: 5hr
Mediastinum-Boundaries and contents	: 1hr
Thoracic duct, Esophagus, Thoracic A	: 1hr
Veins of Thorax	: 1hr
Chambers of heart-All chambers	: 1hr
Splanchnic nerves, sympathetic trunk	: 1hr
Genetics	: 4hr
Classification of chromosomes, karyotyping, sex chromosomes, Barr body	: 1hr
Normal male, normal female, Chromosomal aberrations-in brief	: 1hr
Turner's syndrome, Klienfelter's syndrome and Down's syndromes (Charts to be shown	
Genetic Counseling, Pedigree Chart, Genetic Engineering and inheritance	: 1hr
Head& Neck	: 17hr
Scalp	: 1hr
Parotid Gland	: 1hr
Development of face	: 1hr
Pituitary gland	: 1hr
Dural venous sinuses	: 1hr
Cervical fascia	: 1hr
Development of branchial arches	: 1hr
Extra Ocular muscles	: 1hr
T. M. Joint	: 1hr
Thyroid gland	: 1hr
Cervical Sympathetic	: 1hr
Pharynx	: 1hr
Larynx	: 1hr
Tongue	: 1hr
Facial Nerve	: 1hr
Middle Ear	: 1hr
Seminars (Give more importance to applied Anatomy)	: 13hr
Suboccipital triangle	: 1hr
Eyelid and lacrimal apparatus	: 1hr
Nasal cavity, PNS	: 1hr
Soft palate	: 1hr
Muscles of facial expression	: 1hr
Vessels and nerves of the face	: 1hr

Posterior triangle of neck	: 1hr
Anterior triangle of neck	: 1hr
Mandibular nerve, oculomotor nerve	: 1hr
Submandibular and sublingual gland	: 1hr
Palatine tonsil	: 1hr
Lymph nodes of head and neck	: 1hr
Hyoglossus muscle	: 1hr
Brain and Spinal Cord	: 14hr
Spinal cord- external features and blood supply	: 1hr
Blood supply of brain- Superficial and deep, meninges	: 1hr
Medulla oblongata	: 1hr
Pons	: 1hr
Cerebellum	: 1hr
4th Ventricle	: 1hr
3rd Ventricle, Lateral ventricles	: 1hr
Midbrain	: 1hr
Sulci, gyri and functional areas of cortex	: 1hr
Internal capsule	: 1hr
Visual pathway	: 1hr
Basal ganglia	: 1hr
Thalamus	: 1hr
Development of CNS IN BRIEF including functional Column	: 1hr
Abdomen, Pelvis, and Perineum	: 16hrs
Anterior abdominal wall and Rectus	: 1hr
Inguinal canal, Spermatic cord and descent of testis	: 1hr
Peritoneum in brief	: 1hr
Development of GIT, derivatives and anomalies	: 1hr
Stomach including development	: 1hr
Portal vein	: 1hr
Liver	: 1hr
Kidney -gross features, development and anomalies	: 1hr
Prostate and male urethra	: 1hr
Rectum and Anal canal	: 1hr
Urinary bladder	: 1hr
Perineal Pouches	: 1hr
Ischioanal fossa	: 1hr
Pelvic floor	: 1hr
Seminars (Give more importance to applied Anatomy Lymphatic drainage and blood supply of all organs should be given importance)	: 6hr
Duodenum and development	: 1hr
Pancreas	: 1hr
Extra hepatic biliary apparatus	: 1hr
Supra renal gland	: 1hr
Ureter	: 1hr
Pudendal nerve	: 1hr
Diagrams	
I Cross Section Diagrams	
a Upper limb	

	Name	Fig. No	Page No	Book
1.	Section through middle of arm	68	68	Cunningham's manual of practical Anatomy 15th Edn
2.	Oblique section through the hand	88	90	Cunningham's manual of practical Anatomy 15th Edn
B	Lower limb			
1.	Transverse section through middle of right thigh	124	872	Gray's Anatomy 38 th Edn
2.	Transverse section through middle of leg	182	196	Cunningham's manual of practical Anatomy 15th Edn
3.	Transverse section through knee joint	202	218	Cunningham's manual of practical Anatomy 15th Edn vol.1
C	Neck			
	Transverse section through the neck at the level of cricoid(C6 level) cartilage	62	76	Cunningham's manual of practical Anatomy 15th Edn Vol-3
D	Thorax			
1	Horizontal section through the thorax at the level of T-4 Vertebra	70	58	Vol-2 Cunningham's manual of practical Anatomy 15th Edn
E	Abdomen			
1	Horizontal section through the abdomen at the level of epiploic foramen-T12 vertebra	139	124	"
2	Horizontal section through the abdomen at the level pylorus - L1 vertebra	128	116	"
3	Horizontal section through the abdomen at the level of -L4	129	116	"
F	Brain			
1	Transverse section of medulla at the level of Pyramidal decussation	11.1	137	Cunningham's manual of practical Anatomy 15th Edn Vol-3

2	Transverse section little above pyramidal decussation	11.2	138	""
3	Transverse section at the level of olive	11.3	140	""
4	Transverse section at the level of lower part of pons	11.5	143	" "
5	Transverse section at the level of upper part of pons	11.7	143	" "
6	Transverse section at the level of lower part of mid brain	11.8	144	" "
7	Transverse section at the level of upper part of mid brain superior colliculus	11.9	146 "	" "
8	Horizontal section at the level of inter ventricular foramen	282	286	"
	II Sagittal Section			
1	Sagittal section through shoulder joint	64	65	Vol-1
2	Median section of brain	238	255	Vol-3
3	Median section through malepelvis	235	216	Vol-2
4	Median section through female pelvis	236	216	Vol-2 Cunningham -15th Edn
	111 Gross Anatomy			
	a Upper limb-(1) Typical spinal Nerve	2	6	Vol-1
1	Brachial plexus	24	33	Vol-1
2	Anastomosis around elbow joint	80	82	Vol-1
3	Superficial palmar arch 4 Deep palmar arch	90	92	Vol-1
	b Lower limb			
1	Femoral triangle	131	140	Vol-1

2	Longitudinal arches of foot -Medial - Lateral	213	226	Vol-1
3	Structures surrounding the hip joint	10.33	591	Clinical Anatomy Richard S Snell
	c Thorax			
1	Typical intercostal space	16	12	Cunningham's manual 15th Edn- Vol-2
2	Relations of heart & great vessels to the anterior wall of thorax Surface marking- Borders , Surfaces, valves of heart)	53	44	Vol-2
3	Sternocostal surface of the heart	51	41	Vol2
	Mediastinal surface of lung -Left lung	41	32	Vol2
	Right lung	41	33	Vol2
	Abdomen			
	Visceral surface of liver	176	156	Vol-2
	Structures seen posterior to the stomach	149	132	Vol-2
	Anterior surface of right and left kidney showing relations	191	169	Vol-2
	Posterior surface of right and left kidney showing relations	190	168	Vol-2
	Head and neck			
	Diagrammatic section of eyeball	184	164	Vol3
	Dissection of submandibular region showing hyoglossus muscle and its relations	111	131	Vol-3
	Distribution of cutaneous nerves to Head & Neck	75	98	Vol-3

f	Brain			
	Circle of willis	196	218	Vol-3
	Blood supply of cerebrum			
	Inferior Surface	197	198	Vol-3
	Superolateral surface	201	221	Vol-3
	Medial surface	232	250	Vol-3
	Floor of IV ventricle- posterior view of brainstem	227	243	Vol-3

The question on the diagrams in the question paper carrying 4 marks (2marks each in both Paper 1 & paper 2 should be STRICTLY limited from the above list only)

DETAILS OF PRACTICALS- Dissection including Osteology and Histology)

Upper Limb

Introduction, Pectoral region and axilla, cutaneous nerves and vessels

The brachial plexus

The dissection of back

The free upper limb Lymph vesels and lymph nodes of upper limb cutaneous nerves of upper limb and deep fascia of upper limb

The shoulder- movements of the limb at the shoulder, the shoulder joint

The arm- anterior compartment, Posterior compartment of arm

The forearm and hand, Palmer aponeurosis, superficial palmar arch, Flexorretinaculum, Flexor tendons

The arteries and nerves of the flexor compartment of the forearm

Muscles of the front of the forearm and hand Fascialcompartments of the palm

The extensor compartment of the forearm and the hand, Extensor tendons of the fingers

Joints of the upper limb-elbow joint, urist joint, radio ulnar joints, intercarpal-carpo metacarpal

Intermetacarpal joints

Lower limb

60 hrs

Sole of the foot I and II layers, III and IV layers, V and VI layers

Front of thigh, adductor canal, medial side of thigh, Gluteal region popliteal fossa, Back of thigh, Hip joint

Front of leg and dorsum of foot, superficial dissection

Anterior compartment of leg, lateral and medial compartments of leg, back of leg

Ankle, Tibio-fibular and other joints, revision

Thorax

30 hrs

Introduction: Walls of thorax, Cavity of thorax Mediastinum, Root of lungs Autonomic nervous system The lungs, Anterior mediastinum, Middle mediastinum, surface anatomy of the heart, chambers of heart, right atrium, right ventricle, left ventricle, aorta, superior mediastinum arch of aorta, left atrium, conducting system of heart, Thoracic part of aorta Vagus, Oesophagus, Thoracic duct, Posterior intercostal vessels, Joints of thorax, Revision

Head & Neck

130 hrs

Cervical vertebrae, Skull, The scalp, The temple and the face, Nerves and vessels of scalp and superficial temporal region, The superficial dissection of face, The side of the neck, Sub occipital triangle, The anterior triangle of neck, The median region of the front of neck, subdivisions of anterior triangle, The cranial cavity: Structures seen after removal of cerebrum, Anterior cranial fossa, middle cranial fossa, posterior cranial fossa, Deep dissection of the face: Nerves of the face, Structures in the cheek and lips The eyelids, The lacrimal apparatus The orbits, The structures in the orbits The parotid region, The parotid gland The temporal and infratemporal region Temporal fascia, Temporalis muscle The Superficial contents of the infratemporal fossa Temporomandibular joint, The deeper contents of the infratemporal fossa, the submandibular gland, mylohyoid muscle, hyoglossus stylohyoid, The mouth and pharynx, The cavity of the nose, The larynx, The tongue The organs of hearing and equilibrium The eye ball The contents of the vertebral canal, the joints of the neck.

Brain

42 hrs

Introduction: The membranes of the brain- meninges The blood vessels of the brain The cerebellum, The fourth ventricle, The midbrain, pons, medulla The cerebrum, The White matter of cerebrum III ventricle, the lateral ventricle and the choroid fissure The thalami and the optic tracts The deep dissection of the hemisphere The deep nuclei of the telencephalon The nuclei and connections of the thalamus, Cerebral topography

Abdomen

125 hrs

Introduction: Anterior abdominal wall muscles, inguinal canal Nerves and vessels of anterior abdominal wall Male external genital organs Dissection of the loin

Abdominal Cavity Shape, Boundaries, Divisions of peritoneal cavity Ligaments of liver, Spleen Oesophagus, Vagal trunk, Stomach, Mesentery, Superior mesenteric artery, Inferior mesenteric artery, Arterial anastomosis in GI tract, Structure of small intestine, Large intestine Duodenum, Portal vein, Ducts of liver Pancreas, Liver, Gall bladder, Cystic duct Abdominal structures in contact with diaphragm Autonomic nervous system Supra renal glands, The kidneys, Abdominal part of ureter The diaphragm, The posterior abdominal wall muscles, The inferior vena cava, Lymph nodes of posterior abdominal wall, The nerves of posterior abdominal wall, The pelvic viscera, ovaries, uterine tubes, Pelvic part of ureters, Urinary bladder, Internal surface of urinary bladder, Ductus deferens, Prostate, Male urethra, Uterus, Rectum, Anal canal, Vessels of lesser pelvis, nerves of lesser pelvis, Obturator nerve, Autonomic nerves

The muscles of lesser pelvis, joints of pelvis

Perineum

12 hrs

Ischioanal fossa, Perineal pouches Perineal body, Pudendal canal

Histology

60hrs

Epithelium

Connective tissue

Cartilage- Hyaline, elastic, fibro cartilage

Bone- C.S.L.S

Muscles- Skeletal, Smooth, cardiac

Nervous tissue- neuron, nerve fibre, sciatic and optic nerves, sympathetic, spinal ganglia

Blood vessel- Large and medium sized artery, large and medium sized vein

Lymphoid tissue- lymph node, spleen, thymus, palatine tonsil

Skin- thin, thick

Mammary gland-active inactive

Placenta- umbilical cord

Respiratory system- trachea, lung

Nervous system- spinal cord, cerebrum cerebellum, cornea, retina

Endocrine system- thyroid, parathyroid, supra renal, pituitary

Excretory system- kidney, ureter, urinary bladder

Reproductive system- Male-Female Testis epididymis, vas deferens, prostate ovary uterus-proliferative and secretory, fallopian tube, cervix

Digestive system- Salivary gland- mucous, serous , mixed pancreas, liver, gall bladder, tongue , oesophagus stomach-fundus, pylorus, duodenum, jejunum, ileum, large intestine, appendix

Demonstration of karyotyping charts- Normal male, Normal female, Down syndrome, Tuener's Syndrome, Klinefelter's Syndrome, Chromosome spread

Prescribed text books

1. Cunningham's Manual of Practical Anatomy-3 Volumes, 15th Edition
2. Essentials of Human Anatomy-A.K.Datta, 3 Volumes
3. Text Book of Anatomy by I.B.Singh, 3 volumes
4. Human Embryology-Inder Bir Singh
5. Human Neuro Anatomy-Inder Bir Singh
6. Human Neuro Anatomy-Vishram Singh
7. Text Book of Human Histology-Inder Bir Singh
8. Text Book of Human Histology-Gunasekharan
9. Surface and Radiological Anatomy-A. Halim & A.C.Das
10. Text Book of Osteology by I.B.Singh
11. Text Book of General Anatomy-G.P.Pal
12. Clinically Oriented Problem Based Anatomy-Dr.Neeta Kulkarni.
13. Gross Anatomy Text Books (3 Vol) – Dr. Vishram Singh

Reference text Books

1. Gray's Anatomy- 39th Edition/40th edition
2. Cunningham's text book of Anatomy- 11th edition
3. Grant's Method of Anatomy- J. V. Basmijan

4. Langman's Medical Embryology- T. W. Sadler 11th edition
5. Clinical Neuro Anatomy- Richar S Snell
6. Clinical Embryology- Richard S Snell
7. Essentials of Human Embryolgy- A. K. Datta
8. Essentials of Human Genetics- Bhatnagar, Kothari and Lopa Mehta
9. Histology Atlas- De Fiore
10. Text Book of Histology -Hamilton Bailey
11. Clinically Oriented Anatomy- Keith L Moore, 3 rd edition
12. Gray's Anatomy for students- Richard L Drake
13. The Developing Human- Moore and Persaud 8th edition
14. Clinical Anatomy by Regions Richard S Snell -8th edition
15. Human genetics -S.D.Gangane

Evaluation

University Examination

Theory-Topic Division

Paper I - General Embryology, General Anatomy, Genetics, Upper Limb, Lower Limb, Thorax

Paper II - Head and Neck, Brain, Abdomen, Pelvis, Perineum

MODEL QUESTION PAPER

First Professional MBBS Degree Examination

Paper I - ANATOMY

Time: 3 hrs

Max marks: 50

*Instructions: Draw diagrams wherever necessary
Answer all questions.*

1. A 70 year old man on walking uphill feels sudden onset of severe chest pain radiating to the medial side of left arm associated with tiredness and sweating. He gives a history of similar attacks and was on treatment. With your knowledge in Anatomy answer the following questions.

- Name the organ affected
- Give a brief account of its arterial supply.
- Mention the reason for the radiation of pain.
- Name the covering of the organ and give their nerve supply.

(1+4+2+3=10 marks)

Write briefly on:

2. Inversion and eversion of foot
3. Bronchopulmonary segments of right lung
4. Radioulnar joints

(3x5=15 marks)

Write notes on:

5. Decidua
6. Medial longitudinal arch of foot
7. Clavipectoral fascia
8. Coronary sinus
9. Rotator cuff

(5x3=15 marks)

Write short answers on:

10. Enumerate the derivatives of neural crest
11. Down's Syndrome
12. Microscopic structure of lymph node

(3x2=6 marks)

Draw neat labelled diagram of the following:

13. Sagittal section through the shoulder joint
14. Sternocostal surface of heart

(2x2=4 marks)

MODEL QUESTION PAPER

**First Professional MBBS Degree Examination
Paper -II ANATOMY**

Time: 3 hrs

Max marks: 50

*Instructions: Draw diagrams wherever necessary
Answer all questions.*

1. A 10 year old boy was brought to the O.P with fever and difficulty in opening his mouth and chewing. On examination there was a swelling in front of his left ear associated with tenderness. Based on your knowledge in Anatomy answer the following questions.

- Name the structure affected in this case
- Describe the coverings, surfaces and borders of the structure
- Mention the structure traversing it
- Give the nerve supply of the structure

(1+5+2+2=10 marks)

Write briefly on:

2. Ischioanal fossa
3. Constituent fibres and arterial supply of internal capsule
4. Development and congenital anomalies of palate.

(3x5=15 marks)

Write notes on:

5. Superior constrictor muscle
6. Auditory tube
7. Lateral geniculate body
8. Microscopic structure of retina
9. Superior mesenteric artery

(5x3=15 marks)

Write short answers on:

10. Enumerate the arteries and nerves supplying anterior quadrant of scalp
11. Meckel's diverticulum
12. Coverings of prostate gland

(3x2=6 marks)

Draw neat labelled diagram of the following:

13. Structures seen posterior to the stomach
14. Transverse section through upper part of midbrain

(2x2=4 marks)

9.2 BIOCHEMISTRY

(INCLUDING MEDICAL PHYSICS AND MOLECULAR BIOLOGY)

I) GOAL

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

II) OBJECTIVES

(A) Knowledge: At the end of the course, the student shall be able to;

- (a) Describe the molecular and functional organization of a cell and lists its sub cellular components.
- (b) Delineate structure, function and inter-relationship of biomolecules and consequences of deviation from normal.

- (c) Summarize the basic and clinical aspects of Enzymology with emphasis on diagnostic enzymes.
- (d) Describe digestion, & assimilation of nutrients and consequences of malnutrition
- (e) Integrate the various aspects of metabolism and their regulatory pathways
- (f) Explain the biochemical basis of inherited disorders with their associated sequelae
- (g) Describe mechanisms involved in maintenance of body fluid, and pH homeostasis
- (h) Outline the molecular mechanisms of gene expression and regulations, the principles of genetic engineering and their application in medicine.
- (i) Summarize the molecular concept of defences and their application in medicine.
- (j) Outline the biochemical basis of environmental health hazards, biochemical basis of cancer and carcinogenesis
- (k) Familiarize with the principles of various conventional and specialized laboratory investigations, instrumentation analysis and interpretation of a given data.
- (l) Suggest experiments to support theoretical concepts and clinical diagnosis.

(B) Skills At the end of the course, the student shall be able to

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

(C) Integration the knowledge acquired in Biochemistry shall help the students to integrate molecular events with structure and function of the human body in health and diseases.

DETAILED SYLLABUS

DETAILS OF COURSE

Duration of the course: 2 semesters Total number of hours: 240 Lectures: 160 Practicals + Seminar: 80 Innovative session (projects, seminars, structured discussion, integrated teaching, formative evaluation and revision): Along with practicals.

	DETAILS OF LECTURES	Hours allotted
(1)	Introduction- Structure and functions of cell, cellular organelles and bio membranes, (details of transport and ion channels in physiology).	1 hour
(2)	Biomolecules	15 hours
A.	Proteins Amino acids - classifications based on structure,	3

	<p>polarity, nutritional requirement and metabolic fate Important biochemical properties-ionic properties of amino acids, iso-electric pH, buffering action of amino acids and proteins, biologically important peptides</p> <p>Structural organization of proteins with examples-insulin, collagen, primary, secondary, tertiary and quaternary structure</p> <p>Classification of proteins ,Denaturation, Coagulation ,isoelectric precipitation, precipitation using salt solutions, (colour reactions to be covered with practicals) , Electrophoresis & chromatography– briefly mention on separation techniques (details of techniques and application in practical demonstration)</p>	2	
B	<p>Carbohydrates</p> <p>Classification - Monosacharides – glucose, fructose, galactose, mannose. Reactions- reducing property, oxidation, reduction, furfurals, osazone (details along with practicals) Isomers, anomers and epimers. Derivatives like amino sugars and deoxysugars. Glycosidic bond.</p>	2	
C.	<p>Disacharides – lactose, sucrose, maltose.</p> <p>Poly saccharides – starch, glycogen, dextrans, use of dextrans as plasma expanders, blood group antigens. Glycosaminoglycans (basic structural features and functions), Mucopolysaccharidoses</p> <p>classification and enzyme defect only, blood group antigens</p>	2	
(3)	<p>Lipids Definition</p> <p>Classification with examples, saturated and unsaturated fatty acids, essential fatty acids , PUFA including omega 3 fatty acid ,triacyl glycerols, phospholipids – classification, structure and functions</p> <p>Structure and function of bio membrane</p>	10 hours	
		4	

4	Enzymes	2
	Nature of enzymes, Coenzymes & cofactors, Classification	
	Mechanism of enzyme activity, active site, specificity	1
	Enzyme kinetics, Factors affecting enzyme activity, Km value and its significance(derivation not required)	3
	Types of enzyme inhibition – competitive, non-competitive, uncompetitive, suicidal, allosteric , feedback inhibition, kinetics and their clinical applications	7
	Enzyme regulation in biological systems – allostericregulation, covalent modification, zymogen activation, induction and repression.	2 1
		18
5	Clinical enzymology – functional and non-functional enzymes, Isoenzymes, Diagnostic importance of enzymes – LDH, CPK, AST, ALT, ALP, ACP, GGT, NTP, GPD, cholinesterase, amylase, lipase Cardiac markers Therapeutic enzymes	3
	Digestion and absorption of nutrients – Carbohydrates ,Glucose transporters, disorders associated, dietary fibre	1
	Digestion of lipids and Malabsorption syndrome.	2
	Digestion and absorption of proteins, nitrogen balance, PEM	3
	METABOLISM OF CARBOHYDRATES	
	EMP Pathway -reactions, regulation in brief, energetics	2
6.	Rappaport-Leubering cycle, Fate of pyruvate inaerobic anaerobic conditions, PDH reaction	2

7.	Gluconeogenesis, key enzymes, regulation and significance, Cori cycle	
8	Glycogenesis, glycogenolysis ,regulation in brief ,inborn errors associated	3
. 9. B.	HMP Shunt pathway ,tissues where operating, NADPH generation, Transketolase reaction, G6PDdeficiency, functional significance of HMP shunt (non-oxidative phase need not be elaborated) Uronic acid pathway, Metabolism of galactose, fructose, polyol pathway, inborn errors associated	1 1 17
1.	Regulation of Blood Glucose level Action of insulin, receptors, glucagon, cortisol, growth hormone, adaptation during fed state, fasting state. & in starvation.	3
2	Diabetes mellitus, aetiology, bio chemical abnormalities symptoms & biochemical basis of complications (acute in detail and chronic in brief), Lab diagnosis and monitoring of Diabetes mellitus, microalbuminuria, Glycated hemoglobin.	2
3	Metabolic syndrome - Insulin resistance Glycosurias and reducing substances.	2
4	GTT- procedure, criteria of normal and diabetic status, interpretation of graph.	2
	METABOLISM OF LIPIDS	
5	Fatty acid oxidation- beta oxidation, transport of fatty acids across mitochondrial membrane, regulation, energetics, alpha oxidation-points only, Refsums disease, Zellwegers syndrome. Oxidation of odd chain fatty acid (need not be elaborated),fate of propionyl Co A Synthesis of fatty acids, fatty acid synthase complex, regulation, elongation and desaturation	2
6		4
	Formation and utilization of ketone bodies, ketoacidosis, in diabetes and starvation	1
7	Metabolism of adipose tissue, hormone sensitive lipase, action of hormones insulin, glucagon, epinephrine and cortisol. Liver-adipose tissue axis, Fatty liver and lipotropic factors, obesity,	1
C	Metabolic syndrome in brief.	16

1	Structure, synthesis of cholesterol upto mevalonate in detail then mention the intermediates with basic Chemical changes, regulation, metabolic fate, bile acids formation, bile salts, steroid hormones. Transport of plasma lipids, Lipoproteins-classification, metabolism, functions and disorders	1 3
3	– Dyslipidaemias, atherosclerosis, biochemical basis of management of hyperlipidaemia – diet and drugs, lipid profile.	2
4.	Phospholipids and sphingolipids-inborn errors.	2
5	Eicosanoids - Prostaglandins, thromboxanes and leukotrienes-formation (major steps only), biochemical actions.	2
6	METABOLISM OF AMINOACIDS	2
7	Body amino acid pool, dynamic state of body proteins, inter organ transport of amino acids, glucogenic and ketogenic amino acids	1
8	Reactions - Transamination, decarboxylation, oxidative deamination, transdeamination,	3
	formation and detoxification of ammonia, urea	6
D.	cycle, regulation and energetics, hyperammonemias –acquired and congenital	3
1	Metabolism of glycine, compounds synthesized, inborn errors associated	3
2	Metabolism of Sulphur containing amino acids-methionine and cysteine, transsulphuration, transmethylation, formation of taurine, PAPS, excretion of sulphur, inborn errors associated.	
(6)	Phenyl alanine and tyrosine metabolism, compounds synthesized inborn errors associated and VMA	6

1	Tryptophan- metabolism, compound synthesized and inborn errors associated, Hartnupsdisease, 5HIAA & carcinoid syndrome	4
2	Histidine metabolism and inborn errors	2
(7)	Glutamic acid, GABA, Glutamine, asparagin, Aspartic acid- serine, threonine, arginine, NO and polyamines (synthesis and function), Brached chain aminoacids- MSUD (pathway not required).Biologically important amines, organic acidurias	9
1.	TCA CYCLE AND E T C	4
2.	Reactions, regulation, energetics, and significance, Inter relationship of carbohydrate, lipid, amino acid metabolism	2
3. 4.	Anaplerotic reactions, Amphibolic role , Metabolic adaptation during fed state and starvation	2
(8)	Electron transport system - components and site of ATP Synthesis, Mechanism of Oxidative Phosphorylation. ATP Synthase, uncouplers and inhibitors, brown adipose tissue.	7
1	HAEMOGLOBIN	2
	Heme synthesis & porphyrias- Breakdown of Hb, Biochemical basis of jaundice and distinguishing features of different types of jaundice, neonatal hyperbilirubinemias, lab diagnosis	1 4 3
	Haemoglobinopathies and thalasseмииs, haemoglobin derivatives and significance	
	VITAMINS	6

(10) 1.	(Classification, chemical nature, (detailed structure not required) Dietary sources, coenzyme form biochemical role, deficiency manifestations, daily requirement and toxicity of following vitamins	1
	. Vitamin A, D, K,E	2
2.	Thiamine, Riboflavin, Niacin, Pyridoxine, Biotin, Pantothenic acid	2
3.	Folic acid, one carbon metabolism and B12	
4.	Ascorbic acid and anti-vitamins	1
	MINERAL METABOLISM	
(11)A.	Classification Dietary sources, requirements absorption, biochemical role deficiency and toxicity of the following minerals	24
1.	Calcium and phosphorus - role of PTH, 1,25 DHCC and calcitonin	2
2	Iron – metabolism and disorders	2
3.	Copper, magnesium , trace elements - Zinc ,iodine, Fluoride, Selenium, Manganese Sodium, Potassium chloride	2
	XENOBIOTICS	2
4. B.	Biochemical basis of environmental health & environmental toxicology, mechanism of detoxification and role of cytochrome p 450 Deleterious effects of smoking , alcohol metabolism ,free radicals free radical scavenging system, lipid peroxidation, antioxidants	2

C.	MAINTENANCE OF HOMEOSTASIS	2
D. E.	Acid base regulation: pH, Acids, Bases, Buffers, Henderson Hasselbalch Equation in relation to body systems (derivation not required), buffer capacity	1 3
F.	Body buffers, Role of kidneys and lungs in Acid base homeostasis.	2
G.	Acid base disorders, causes , compensatory mechanisms , anion gap, assessment of acid base status	3
H.	Fluid and electrolyte balance – distribution of body water and disorders (hormonal regulation not in detail)	3
	NUCLEIC ACIDS and MOLECULAR BIOLOGY	3
	Structure of purines, pyrimidines, nucleosides, nucleotides	3
(12)	Purine: nucleotide synthesis and catabolism and inborn errors (synthetic pathway need not be considered in detail, with names of intermediates. Only the source of different atoms and sequence of addition). Salvage pathway and regulation, hyperuricemia and gout, Lesch Nyhan syndrome, hypouricemia	3
(13)	Pyrimidine: nucleotide synthesis, regulation, oroticaciduria, formation of deoxy nucleotides, thymidylate synthase reaction, folicacid antagonists and nucleotide analogues as chemotherapeutic agents(Antimetabolites)	4 3
(14)	Nucleic acids: structure and organisation of DNA, different types of DNA, mitochondrial DNA, base pairing rule, differences between DNA and RNA, different types of RNADNA replication, Telomerase, DNA polymerase, DNA repair (basic mechanism of repair and disorders Transcription, RNA polymerase, post-transcriptional modifications, splicing, inhibitors, reverse transcriptase, ribozyme	1 9

		2
	Genetic code, tRNA, ribosomes	1
	Translation, steps, post-translational modifications, inhibitors, Protein folding in brief and conformational disorders - chaperon, prion disease, protein targeting	2
		2
	Regulation of gene expression, induction, repression and depression. Gene rearrangement in brief	2
	Recombinant DNA technology, restriction endonucleases; southern, Northern and Western blotting. RFLP, DNA finger printing, Polymerase chain reaction, anti-sense therapy, Gene therapy, clinical application of above techniques, cloning	
	Biochemical basis of inherited disorders: Mutations, Pathogenesis of inborn errors of metabolism in general, types of mutations with examples in each case, mode of inheritance, Mitochondrial DNA and mitochondrial myopathies	
	PLASMA PROTEINS & IMMUNOGLOBULINS.	
	<p>Functions of plasma proteins, transport proteins, acute phase proteins Structure and functions of immunoglobulins, hyper and hypo gammaglobulinemias, monoclonal antibodies, multiple myeloma and Bence-Jones proteins, biochemistry of AIDS –immunology, reverse transcriptase and lab diagnosis- ELISA, Southern blot, PCR</p> <p>BIOCHEMISTRY OF CANCER</p> <p>Cell cycle, apoptosis, mutagens, Role of carcinogens in carcinogenesis, Tumour suppressor genes, oncogenes, viruses in carcinogenesis tumour markers- common parameters and their utility in clinical practice.</p> <p>CLINICAL CHEMISTRY</p> <p>Liver function tests- Common tests</p> <p>1 Performed serum bilirubin, enzymes, AG ratio, BSP test, urine tests and and interpretation of laboratory reports.</p> <p>2 Thyroid function test and interpretation</p> <p>3. Renal function tests- BUN ,NPN, Clearance</p>	

	test , tests of tubular function urine analysis and clinical interpretation of laboratory reports, newer renal markers – Cystatin C
4	Special laboratory investigations –RIA,ELISA, Principles of colourimetry,
5	Radioactivity – diagnostic, research, & therapeutic applications and radiation hazards
	(The topics mentioned above have to be covered within the stipulated period of one year. Hence the basic fundamentals may be covered as lectures and the other topics as tutorials, group discussions, integrated teaching sessions (horizontal and vertical), seminars and symposia. In all these sessions active participation of students must be ensured. A few topics have been identified for the non-conventional type of learning)

TOPIC DIVISION

PAPER-1 Topics (1) to (5)

Introduction, biomolecules, Enzymology, Digestion and Absorption of nutrients, Metabolism of Carbohydrates, Lipids, Proteins, TCA cycle & ETC

PAPER -II Topics (6) to (14)

Haemoglobin,, Vitamins , minerals, Xenobiotics, maintenance of homeostasis , Nucleic Acids & Molecular Biology, plasmaproteins & Immunoglobulins, Biochemistry of Cancer and clinical chemistry

DETAILS OF PRACTICALS 35sessions

1. Reactions of carbohydrates: glucose, fructose, lactose, sucrose 4 sessions
2. Reactions of proteins
3. sessions 3.Reactions of urea and uric acid/creatinine 1session (Hypobromite and specific urease test for urea and Benedict's test and Schiff's test for uric acid, Jaffe's test)
4. Identification of biochemically important compounds in given solution 3sessions
5. Normal urine-organic and inorganic constituents 2sessions 11
6. Abnormal urine-urinalysis (physical and chemical) 3sessions
7. Demonstration of electrophoresis-agargel-interpretation of simple patterns 1session
8. Demonstration of chromatography-paper/TLC-Diagnostic importance 1session
9. Haemin crystals 1session
10. Introduction to clinical chemistry-collection of samples, anticoagulants and Preservatives, principles of colorimetry 1session
11. Estimation of glucose-GTT curves-lab data analysis 1sessions
12. Estimation of urea in serum-calculation of clearance from given values of U and V 1session
13. Estimation of creatinine in urine or serum-calculation of clearance 1session
14. Estimation of total protein and albumin-A/G ratio 1session
15. Spotters-Demonstration –Simple instruments, graphs, tests etc. 1session

16. (a) Laboratory data interpretation-liver diseases, renal diseases, acid base disturbances, Diabetes mellitus, cardiac diseases, lipid profile-data interpretation, lipid disorders 2sessions
 (b) Problem solving exercises-short history of different conditions may be given and students will be asked to suggest investigations to arrive at a diagnosis 2sessions
17. Revision -5 sessions

TEACHING LEARNING METHODS			
Structured Interactive sessions, Tutorials, Group Discussions, Seminars,			
Projects, Self learning modules and e- modules etc.			
5 sessions			
SUGGESTED BOOKS IN BIOCHEMISTRY			
Books for study:			
1. Text of Biochemistry for Medical students by Vasudevan & Sreekumari -			
latest edition			
2. Harper's review of Biochemistry- latest edition			
3. Medical Biochemisty by Dinesh Puri -latest edition			
4. Lippincott's Illustrated Review of Biochemistry -latest edition			
Books for Reference:			
1. Principles of Biochemistry by Lehninger			
2. Biochemistry with Clinical Correlations by Thomas . M. Devlin			
3. Biochemistry by Stryer			
4. Biochemistry-A case oriented Approach by Montgomery			
5. Textbook of medical Biochemistry by Bhagwan			
Evaluation			
University examination		Marks	
Theory paper I & II		50 + 50 =	100
Internal assessment			20
Viva			20

Practical I & II		20 + 20	=	40
Internal assessment				20
Total				200

MODEL QUESTION PAPER

**First Professional MBBS Degree Examination
Paper - I BIOCHEMISTRY**

Time: 3 hrs

Max marks: 50

Instructions:

Draw diagrams wherever necessary

Answer all questions

1. Name the sulphur containing amino acid. Discuss metabolism of the essential amino acid of this group and add a note on associated inborn errors.

(1+5+4=10 marks)

Discuss the following:

2. Complication of Diabetes mellitus
3. Components and sequence of reactions occur in Electron transport chain.

(2x5 =10 marks)

Write short notes on:

4. Structure of human insulin.
5. Structure of bio membrane.
6. Fatty acid synthase enzyme complex.
7. Glycation of haemoglobin and its significances.
8. What is the Normal serum cholesterol? Why HDL & LDL Cholesterol are known as good and bad cholesterol respectively?

(5x3 =15 marks)

Write briefly:

9. Key enzymes of gluconeogenesis.
10. Energy expenditure in Urea cycle.
11. Importance of Carnitine in lipid metabolism
12. Deficient enzyme and clinical features in galactosemia.
13. What is the biochemical basis of fatty liver in alcoholism?

(5x2 =10 marks)

Give precise answers:

14. What is the basis of curdling of milk?
15. Mention any four fate of acetyl CoA.
16. Mention any two functions of phospholipids.
17. Mention any two enzymes used as therapeutic agents
18. Why sample for glucose estimation is collected in a fluoride bottle?

(5x1 =5 marks)

MODEL QUESTION PAPER

**First Professional MBBS Degree Examination
Paper - II BIOCHEMISTRY**

Time: 3 hrs

Max marks: 50

Instructions:

*Draw diagrams wherever necessary
Answer all questions.*

1. What is translation? Discuss the process of translation and add a note on post translational modifications.

(1+6+3=10 marks)

Discuss the following

2. Porphyrias.
3. Renal mechanism of regulation of blood pH

(2x5=10 marks)

Write short notes on:

4. Telomerase
5. Orotic aciduria.
6. Cytochrome P450.
7. Diseases related to copper metabolism
8. Role of one carbon compounds in purine & pyrimidine formation.

(5x3=15 marks)

Write briefly:

9. Creatinine clearance
10. Metabolic role of vitamin C.
11. Factors affecting electrophoresis.
12. Effects of radiation on normal tissue
13. Deficient enzyme and clinical features in Lesch – Nyhan syndrome.

(5x2=10 marks)

Give precise answers:-

14. Nucleosomes
15. Klenow fragment
16. Name two selenium containing enzymes.
17. Mention any two oncosuppressor gene.
18. Name the most important extra cellular caution and write its normal serum level.

(5x1=5 marks)

9.3 HUMAN PHYSIOLOGY INCLUDING BIO-PHYSICS

(I) GOAL

The broad goal of the teaching of undergraduate students in physiology aims in providing the student, a comprehensive knowledge of the normal functions of the organ systems of the body and their interactions to facilitate understanding of the physiological basis of health and changes in disease. The broad goal of teaching Biophysics to undergraduate students is that they should understand basic physical principles involved in the functioning of body organs in normal and diseased conditions.

(II) LEARNING OBJECTIVES**A. Knowledge**

At the end, a medical student in Physiology should be able to explain:

- (a) Functions of organ systems in a normal subject.
- (b) Contribution of organ systems and their integration in maintenance of homeostasis
- (c) Altered physiology on exposure to stress, and during disease process
- (d) Compare the normal and abnormal data; interpret the same to assess health status
- (e) Physiological principles underlying pathogenesis and treatment of disease.
- (f) Reproductive physiology as relevant to National Family Welfare programme
- (g) Basic laboratory investigations relevant for a rural set up
- (h) Concept of professionalism
- (i) Approaches to the patient with humanity and compassion

B. Skills

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

- (a) Conduct experiments designed for study of physiological phenomena
- (b) Interpret experimental / investigative data
- (c) Distinguish between normal and abnormal data derived as a result of tests which he/she has performed and observed in the laboratory

C. Integration

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

(III) DETAILED SYLLABUS

DETAILS OF THE COURSE

Duration of the course: 2 semesters

Total number of hours: 480

Lectures	: 160
Practicals	: 120
Innovative session (Projects, seminars, structured discussion, integrated teaching, formative evaluation and revision	: 200

DETAILS OF CLASSES IN PHYSIOLOGY

General Physiology

LECTURES	3 hrs
Introduction to Physiology Principles of Homeostasis Structure of cell membrane Transport Mechanism Intercellular communication	
	2 hrs
Body Fluid compartments – divisions, composition, and determination (mention Fick's principle) Blood volume – normal value, abnormalities – hypovolemia & hypervolemia	
	1 hr
SEMINAR/ TUTORIAL	
Apoptosis and aging	1 hr
Homeostasis	2hrs

HEMATOLOGY

LECTURES	20 hrs
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Introduction

Blood - Functions, composition, Properties – specific gravity, viscosity – definition, normal values & variations

Plasma proteins: types, quantity, functions, A: G ratio, abnormal proteins (2) - Bence Jones & C reactive proteins 1 hr

Red Blood Cells

Morphology, composition and functions, normal RBC count and variations

Properties – PCV, ESR, Osmotic fragility – definition, normal values, factors affecting and variations (methods in practical classes).

1 hr

Haemoglobin – outline only normal basic structure, normal content, functions, types (Hb A, Hb A2 and Hb F) abnormal Hbs (only two - Thalassemias & Haemoglobin S)

1 hr

Erythropoiesis – sites (intra and extrauterine) different stages, Factors influencing & regulating Erythropoiesis Life Span of RBC and its destruction (outline), jaundice (mention)

1 hr

Anaemias – definition, classifications (etiological, morphological), physiological basis of anaemias (briefly), iron deficiency anaemia, Pernicious anaemia, aplastic anaemia, Hemolytic anaemia (briefly), Polycythemia- primary and secondary

Bone marrow study – Importance, myeloid: erythroid ratio

1 hr

White Blood Cells:

Classification, morphology (details in practical classes), lifespan

Properties and functions – Neutrophil, Eosinophil, Basophil, Monocyte, Lymphocyte

Normal total and differential count (methods in practicals), variations Leucocytosis, Leucopenia, leukaemia (definition, mention difference from leucocytosis), agranulocytosis,

Leucopoiesis

4 hrs

Immunity

Definition,

Types – innate and acquired, Humoral and cellular

Mechanisms of immune response, plasma cell, immunoglobins, Autoimmune disorders, AIDS (mention)

1 hr

Platelets:

Morphology, properties and functions, normal count, variations, thrombopoiesis, and factors Influencing this

1hr

Reticulo endothelial system (briefly)

½ hr

Haemostasis

Primary (vasospasm, platelet plug formation) and Secondary (extrinsic and intrinsic mechanisms of coagulation of blood)

Clot retraction (mention)

Anticlotting mechanisms in vivo -factors that limit clot formation (Protein C, Protein S and antithrombin III) and fibrinolytic system (all in brief)

Anticoagulants - used in lab and in vivo

Bleeding disorders

Purpura, Hemophilia, Vitamin K deficiency

Tests for bleeding disorders – bleeding time, clotting time (in practicals)

Prothrombin time and PTT (principles only)

Thrombosis and Embolism – mention

4hrs

Blood groups

ABO and Rh systems, inheritance, differences, Bombay group,

Landsteiner's laws I and II

Mention about other minor blood groups, Bombay blood group (mention)

Blood grouping and cross matching (importance), concept of universal donor and recipient

ABO and Rh incompatibility – important manifestations, erythroblastosis foetalis

Management and preventive measures, Medicolegal and clinical importance (briefly)

2 hrs

Blood banking and transfusion

Blood transfusion – indications, precautions and complications
 Blood Banking – anticoagulants used, storage, changes during storage
 Transfusion of blood components – with special reference to recent advances

1½ hrs

Lymph – formation, circulation, functions

Tissue fluid – formation, circulation and functions

Starling's hypothesis – edema formation

1hr

SEMINARS / TUTORIAL

Reticuloendothelial system

2 hrs

INTEGRATED TEACHING

Immune mechanisms (with microbiology department)

Modern trends in blood banking (with transfusion medicine department)

Blood and bone marrow smears – normal and abnormal (with pathology dept)

6 hrs

CARDIOVASCULAR SYSTEM**LECTURES**

24 hrs

Functional anatomy of heart and blood vessels

Chambers, valves, great vessels, Systemic and pulmonary circulations

Structure and functions of different segments of blood vessels – correlate with functions

Properties of cardiac muscle

Excitability, rhythmicity, conductivity, contractility, distensibility, Treppe (mention)

1hr

Conducting system of heart

Parts of conducting system, origin and spread of cardiac impulse,

Abnormal pacemakers, conduction defects

1hr

Cardiac cycle:

Definition, phases, events of cardiac cycle

Pressure changes – Atria, Jugular vein (mention clinical significance).

Ventricles – right and left

Aorta and Pulmonary artery

Methods of measurement, cardiac catheterization – basic principle

Volume changes – in different chambers.

Heart sounds – causes, character, murmur (definition, physiological basis)

Arterial Pulse - genesis and characters of normal pulse

Common abnormalities in practical classes

Venous blood flow-Venous tone, valves

Correlation between different events of cardiac cycle – (diagrammatic representation)

Echo cardiography (principle only)

5hr

ECG

Definition, Principles of recording of ECG (details in practical)

Leads – unipolar and bipolar, commonly used 12 Leads

Normal tracing in Lead II – normal waves, intervals and segments, how HR is determined, correlation with action potential and phases of cardiac cycle

Clinical uses of ECG – (mention)

Abnormal ECG pattern in myocardial infarction, cardiac arrhythmias (briefly)

Effect of changes in ECF K⁺, Ca⁺⁺ and Na⁺ Conduction defects - define IO, 20 and 30 block (mention)

2hr

Cardiac output:

Definition, normal values, variations

Method of measurement (Fick's principle – mention)

Regulation of cardiac output – heart rate - Regulation of heart rate, stroke volume – determinants, regulation

Correlation of normal ECG pattern with events of cardiac cycle in a diagram

5hr

Haemodynamics

Functional organisation correlated with structure of vascular system (review)

General principles including physical laws governing flow of blood in heart and blood vessels -Pressure – resistance - flow relationship, Poiseuille-Hagen formulae, law of Laplace

Laminar flow, turbulent flow, Reynold's number, critical closing volume

Importance of peripheral resistance, venous circulation, venous tone

Regulation of blood flow

2hr

Arterial Blood pressure

Systolic and diastolic pressures– definition, normal values, variations

Define end pressure and lateral pressure, Bernoulli's principle (mention)

Pulse pressure, Mean arterial pressure - definition, normal values

Determinants of Systolic and diastolic pressures

Measurement– details in practical class

Regulation - neural and humoral.(short term, intermediate and long term)

Cardiovascular reflexes

Local regulation including auto regulation of blood flow, vasoconstrictors and vasodilators, substances secreted by endothelium (important ones)

Effects of gravity, Posture and Exercise on B.P

Hypertension & hypotension

3hr

Regional circulation

Coronary, capillary, cutaneous, cerebral, foetal, pulmonary, renal, and splanchnic circulation to be taught in respective systems

3hr

Circulatory shock

Types pathophysiology, stages, compensatory mechanisms

1hr

Cardio-vascular adjustments in health and disease

Effects of exercise, effect of gravity (+ve and -ve), weightlessness (brief)

1hr

Seminar/tutorial

Cardiovascular changes in exercise

Effect of gravity (+ve and -ve), weightlessness

2hr

Integrated teaching

Current investigative procedures in cardiology (with cardiology dept)

2hr

Respiratory System

LECTURES

16 hrs

Introduction

Define respiration

Organisation and functional anatomy of respiratory system

Tracheobronchial tree, Respiratory unit, Alveoli (structure and functions), Pleura, pleural fluid Functions of different parts of respiratory system including non-respiratory functions
-1hr

Mechanics of respiration

Inspiration and expiration, muscles of inspiration and expiration and their actions, Pump handle and bucket handle movements, expansion of thorax and lungs,

Types of breathing

Pressure changes during normal respiratory cycle – intra (alveolar) pulmonary and intra thoracic (alveolar) pressure changes, development of negative intra thoracic pressure

Surfactant – functions (surface tension, alveolar stability, alveoli kept dry, interdependence of alveoli), hyaline membrane disease, ARDS

Law of laplace – application

-2hrs

Measurement of pulmonary ventilation

Lung volumes (mention) static & dynamic lung volumes TV, IRV, ERV, RV, VC TLC, FEV, FRC – Residual volume (measurement not needed) RMV, MVV, breathing reserve, closing volume (mention) Ventilation – pulmonary and alveolar

Dead space – Anatomical & Physiological- definition, normal values, variations (1-2 eg) (Measurement not needed)

-2 hrs

Pressure – volume relation ship

Elastic behaviour of lungs, total and lung compliance – normal values

Airway resistance, work of breathing (brief outline –it is to overcome elastic, nonelastic and airway resistance), factors affecting bronchial tone, 1-2 conditions where work of breathing is increased

-1 hr

Pulmonary blood flow

Volume, pressure, factors influencing – nervous and chemical factors, unique features. Variations in regional pulmonary blood flow, ventilation – perfusion ratio and its importance

-1 hr

Pulmonary gas exchange

Composition of inspired air, expired air, partial pressures gas composition of Arterial & venous blood

Mechanism of gas exchange

Structure of blood gas barrier, factors affecting diffusion across respiratory Membrane diffusion capacity for O₂ & CO₂,

O₂ transport in blood - oxygenation of Hb, O₂ carrying capacity, O₂ content, % saturation, coefficient of O₂ utilization, Properties of Hb that facilitates O₂ transport O₂ dissociation curve, factors shifting curve to right and left, P50 foetal Hb, Myoglobin, carboxy Hb.

-2 hrs

Co₂ transport in blood

Different forms of transport, chemical reactions involved, changes occurring in lungs
Haldane and Bohr effect

-1 hr

Regulation of respiration

Neural control – neural centres, genesis of respiratory rhythmicity, ramp signal
(experimental evidence not required), Voluntary control, Reflex control Breath holding and
braking point

Chemical control – stimuli, chemoreceptors (peripheral and central), ventilatory response to
hypercapnea, hypoxia and change in H⁺ ion concentration, Interactions between these
chemical stimuli (mention –details not required)

-3hrs

Hypoxia

Definition, types, clinical features, differences Oxygen therapy

Cyanosis, asphyxia and dyspnoea

Definition, CO poisoning (mention)

Periodic breathing Cheyne – stokes and biots breathing, voluntary hyperventilation

-1hr

Environmental Physiology

High altitude, rapid ascent, mountain sickness, acclimatization Effects of UV rays, dysbarism

-1hr

Effects of increased barometric pressure

Nitrogen narcosis, High pressure nervous syndrome, Oxygen toxicity Decompression
sickness (Caissons disease)

-1hr

Artificial respiration

Mouth to mouth, Holger-Neilson method, mechanical methods, ventilators

-1 hr

SEMINAR / TUTORIAL

Respiratory changes during exercise

Space physiology – effect of “G” forces on respiratory system

INTEGRATED TEACHING

-4 hrs

Pulmonary (Lung) function tests (with respiratory medicine dept)

Cardiopulmonary resuscitation

Gastrointestinal System**LECTURES****-12 hrs**

Introduction to G.I. Physiology

General organization of G.I. tract Neural control of G.I function enteric nervous system,
autonomic control Mechanism of enzyme secretion by glands in general

-1hr

Salivary glands

Functional anatomy (types and location) with relevant histology in brief

Saliva

Composition, functions, control of secretion

Conditioned and unconditioned reflexes

Disturbances in salivary secretion – in anxiety and dehydration

-1 hr

Gastric secretion

Functional anatomy of stomach and different gastric glands

Gastric juice: Composition, functions

Gastric HCl secretion - mechanism and regulation of secretion

Gastric juice -Functions, phases of secretion and regulation

Gastrin – functions and regulation of secretion

Mucosal barrier, pathophysiology of peptic ulcer in brief

-3hr

Pancreatic secretion -- exocrine Pancreas

Functional anatomy with relevant histology

Pancreatic juice: Composition, function, and regulation of secretion

(neural and humoral – CCK and secretin)-applied importance (mention steatorrhoea)

-2hr

Liver and gall bladder

Functions of Liver, Functional anatomy with relevant histology

Composition and functions of bile, control of secretion

Functions of gall bladder, filling and emptying of gall bladder

Enterohepatic circulation, Jaundice – prehepatic, hepatic and post hepatic in brief

Small intestine

Functional anatomy with relevant histology

Composition, regulation of secretion, and functions of intestinal juice

Small intestine – Functions

-1hr

Movements of G.I. tract

Electrophysiology of smooth muscle in the GIT (revise) – BER, MMC

Peristalsis – definition, basis, functions

Mastication – definition, muscles involved, functions and regulation

Deglutition – definition, muscles involved, stages, functions and regulation

-1hr

Gastric motility – types, regulation, abnormal movements (vomiting, diarrhoea)

Gastric emptying – duration, factors affecting

-1hr

Movements of small intestine

Types with reference to BER – mixing, pendular, movements of villi and peristalsis

-1hr

Large intestine

Functions – secretory, motor, absorptive, synthesis of short chain fatty acids

Defecation reflex

Role of dietary fibre, bacterial flora -1 hr

SEMINAR / TUTORIAL

Gastro intestinal hormones (Gastrin, CCK-PZ, Secretin, Villikinin, VIP, GIP) -4hr

ASSIGNMENT

Bowel function test and blind loop syndrome
Digestion and absorption of carbohydrates, fats and lipids -4hr

INTEGRATED TEACHING

Liver and biliary system (depts of physiology, anatomy, biochemistry and internal medicine) -2hr

Renal System

LECTURES

Introduction Functions of kidney – homeostasis, as an endocrine organ Functional anatomy of Kidney Nephron-structure, parts, function, types (in detail)

Renal circulation

Normal flow, regulation, peculiarities, and principle of measurement
Juxtaglomerular apparatus
Site, structure, function

-1hr

Glomerular filtration

Definition, rate, filtration membrane, forces governing filtration and permeability of the membrane, measurement of GFR Clearance values – definition, values for glucose, inulin, and urea

-2hrs

Tubular functions

Tubular reabsorption – define Sodium, glucose, water, urea, electrolytes - sites, mechanisms involved Water - reabsorption in different segments – obligatory and facultative

Tubular secretion – H⁺ (acidification), K⁺ Filtered load, Tubular maximum, glomerulo tubular feedback, and renal threshold

- 1 hr

Acidification of urine Mechanisms and sites of H⁺ secretion, pH changes along renal tubules, fate of H⁺ in the renal tubule (buffer systems), non-ionic diffusion

-1 hr

Concentration of urine Counter current system – multiplier, exchanger Cortico medullary gradient – factors maintaining (ADH, permeability characteristics of renal tubule, role of urea and vasa recta) Osmotic gradient along renal tubules Diuresis – definition, osmotic and pressure diuresis

-2hrs

Micturition

Functional anatomy of bladder -muscles and sphincters and innervation of bladder, Filling and emptying of bladder, Cystometrogram Micturition reflex and its higher control, voluntary control Abnormalities of micturition – deafferented, decentralised and automatic bladder
-2 hrs

Urine

Normal volume, constituents Abnormal constituents – albuminuria, glucosuria (mention) Polyuria, Oliguria, Anuria (mention) Dialysis – artificial kidney (basic principles of hemo and peritoneal dialysis) Renal function tests (mention)
-1 hr

SEMINAR / TUTORIAL

-6 hrs

Acid base balance

Juxtaglomerular apparatus

Water and electrolyte balance

Skin and Temperature regulation

Structure and function of skin

Methods of heat conservation and loss in human body Regulation of body temperature – role of skin, hypothalamus Hyperthermia, Fever, Heat stroke, hypothermia, cold injuries (frost bite)
-2 hrs

NERVE – MUSCLE PHYSIOLOGY**LECTURERS**

-10 hrs

Excitable tissue

Definition, properties

Neuron

Structure of a typical neuron, types, properties, functions

StimulusDefinition, types – threshold, subthreshold, suprathreshold
-1hr**Nerve fibres**

Types, classification, and functions

Resting membrane potential

Definition, ionic basis and genesis
-1hr**Nerve action potential**

Definition, ionic basis and properties, Monophasic, biphasic and compound action potential
-1hr

Transmission of nerve impulses

Types (myelinated and unmyelinated), differences in impulse transmission

Velocity of conduction and factors affecting it -1hr

Peripheral nerve injury

Wallerian degeneration, regeneration, denervation hypersensitivity -1hr

Neuromuscular junction

Functional anatomy, transmission of impulses across neuromuscular junction, EPP

Neuromuscular blocking drugs (important ones with clinical correlation)

Pathophysiology of Myasthenia Gravis -1hr

Muscles

Classification

Skeletal muscle

Structure including molecular details, properties

Action potential - Definition, ionic basis and properties, Comparison with nerve action potential

Molecular basis of muscle contraction - Excitation – contraction coupling

Types of muscle contraction – isotonic and isometric with examples

Muscle types – fast and slow, differences

Energy sources and metabolism in muscle at rest and during contraction

Muscular changes during exercise

Length –tension relationship

EMG – basic knowledge of what it is and clinical importance

Fasciculation, fibrillation (briefly) -2hrs

Cardiac muscle

Structure, properties

Action potential- Definition, ionic basis and properties, Comparison with nerve and muscle action potential

Pacemaker potential - molecular basis, properties

Mechanism of contraction

Length – tension relationship -2hrs

Smooth muscle

Types, Structure, innervation and neuromuscular junction

Potentials –types, ionic basis

Mechanism of contraction - Excitation – contraction coupling

Plasticity (cystometrogram to explain)

Length – tension relationship (mention) -1 hr

SEMINAR / TUTORIAL

Comparison of structure and functions of the three types of muscles

Comparison of the excitation – contraction coupling in the three types of muscles

INTEGRATED TEACHING

EMG

NERVOUS SYSTEM

LECTURES

-30 hrs

Organisation of nervous system

General organisation Functional anatomy of brain and spinal cord, Coverings, white and grey mater – review briefly

Brain – lobes, functions, Brodmann's areas –important ones with functions Neuron, neuroglia – functions **Spinal cord** – Functional anatomy -coverings, structure, white and grey mater Cross section with location of sensory, motor and autonomic neurons and tracts

-2hrs

Cerebro spinal fluid

Ventricles of brain, Blood-brain barrier- importance CSF – formation, circulation, composition, functions, Lumbar puncture (brief)

-1½ hrs

Synapse

Types

Functional anatomy of typical chemical synapse and synaptic transmission Synaptic potentials – EPSP, IPSP –ionic basis and comparison with action potential

Properties of synapses (one way conduction, synaptic delay, synaptic inhibition, convergence, divergence, summation, fatigue, after discharge and synaptic plasticity)

Synaptic inhibition –types, mechanisms with examples

Neurotransmitters – facilitatory and inhibitory with 2-3 eg and clinical applications

-3hrs

Reflex action

Definition, reflex arc - components Classification with examples -Mono and polysynaptic, Somatic and visceral, Superficial and deep with mention of examples (details of reflexes in motor system)

Sensory receptors

Classification (recent view), types (phasic and tonic), properties - adaptation Receptor potential, comparison with action potential

Sensations

Classification

-1hr

Sensory tracts

Organisation of sensory pathways

Name all ascending pathways of spinal cord

Tracing of pathways from body and face

Medial lemniscal system – dorsal column sensations

Spino thalamic system

- Sensation of touch and pressure
- Sensation of pain and temperature

Synthetic sensations

- Other ascending tracts – salient features-spinoreticular, spinocerebellar
- Pain Sensation – details

Different types of pain

Slow and fast pain – types of fibres, tracts and terminations

Modulation of pain - Spinal level, supra spinal level

Visceral pain, referred pain, radiating pain, - clinical correlates
Altered pain sensations -3hrs

Thalamus

Functional anatomy, nuclei – classification, connections, Functions of thalamus
Thalamic syndrome -1hr

Sensory Cortex

Location – primary area, secondary area, association areas
Salient histological features
Body representation -sensory homonculus
Functions of primary, secondary and association areas
Lesions -1hr

Cerebral Cortex

Brodmann's areas other than sensory & motor areas, Functions

Motor system

Introduction, levels of motor control, review cross section of spinal cord

Reflex action

Definition, reflex arc - components
Classification with examples (brief review)
Stretch reflex, inverse stretch reflex, reciprocal innervation, withdrawal reflex
o Review cross section of spinal cord – various ascending and descending Pathways
o Stretch reflex – details and function
Inverse stretch reflex, Reciprocal innervation, Other poly synaptic reflexes
Pathological – Babinske sign -2hrs

Motor Cortex

Primary motor area and pre motor areas, Histological features
Body representations -homonculus
Functions

Descending tracts

General organisation, Pyramidal and extra pyramidal tracts, their functions
Mention as medial and lateral systems, Upper motor neurons and lower motor neurons
Upper motor neuron and lower motor neuron lesions – differences
Effects of lesions at various levels - hemiplegia, paraplegia, monoplegia -3hrs

Spinal cord injuries

Injuries of spinal cord: complete transection, incomplete transection, hemisection, section of anterior and posterior roots, injury to motor nerve -2hrs

Basal ganglia –

Organisation
Normal Neuronal masses included
Connections (afferent, efferent, inter connections)
Functions
Disorders – Parkinsonism, Chorea, Athetosis with explanation of the Physiological basis of the signs and symptoms

Wilson's disease – mention -2hrs

Cerebellum

Functional anatomy, Functional and evolutionary divisions, functions
Deep cerebellar nuclei, connections in relation to functions, functions

Neuronal circuit (mention)

Cerebellar lesion – features and their physiological basis -2hrs

Reticular formation

ARAS, descending reticular system –explain control of muscle tone

Limbic system

Organisation, connections (mention important ones) and functions -1hr

EEG and sleep

Define EEG, principle of recording,

Normal waves (α , β , δ and θ), alpha block, Clinical uses (mention) -1hr

Vestibular apparatus

Functional anatomy - gross structure, receptors, receptor potential Connections and
Vestibular pathway, Functions -2hr

Muscle tone, posture, equilibrium

Basis of maintenance – stretch reflex, higher control,

Postural reflexes – mention with levels of integration (details not required)

Regulation of muscle tone and posture -1hr

Hypothalamus

Functional anatomy, Nuclei, connections and functions (neural) -1hr

Higher functions of the brain

Learning

Memory – types -

Speech – Types, Mechanisms of speech, Aphasia – classification -2hr

Autonomic nervous system

Organisation and functions

SEMINAR / TUTORIAL

-8hr

Autonomic nervous system: sympathetic and parasympathetic systems.

Higher control – role of reticular formation and hypothalamus -2hr

Hypothalamus: Nuclei, connections and functions -2hr

Limbic system: parts and functions

CS of Spinal cord: to show tracts: Effects of lesions of spinal cord, nerve roots and nerves -2hr

CSF: Formation, circulation, composition and functions -2hr

SPECIAL SENSES

LECTURES -10hr

Olfaction -1hr

Receptor, pathway, lesions – anosmia, parosmia

Taste -1hr

Taste buds, receptor, primary taste sensations, pathway

Vision
LECTURES -8hr

Introduction

Functional anatomy of eye – Review

Chambers of the eye, intraocular fluids - aqueous humor, vitreous humor

Lens - characteristics, changes with age, aphakia, cataract

Retina – Histology to be reviewed, Macula lutea, fovea centralis – Explain -1½ hr

Basic optics

Optical system of the eye

Refractive media of eye -Refracting surfaces & refractive indices

Concepts of reduced eye, Image formation on retina

Emmetropic eye

Far and near points

Accommodation and accommodation reflex (Near response) –

3 components - Pupillary constriction, convergence of eye balls, increased anterior curvature of lens.

Range and Amplitude of accommodation

Errors of refraction – chromatic and spherical aberrations, hypermetropia, myopia, and Astigmatism

presbyopia, – causes (brief) features and corrective lenses

Contact lenses (mention) -2hr

Visual receptors (cones and rods)

Structure in detail

Visual pigments, role of vitamin A

Phototransduction

Adaptations of visual receptors -Dark adaptation and light adaptation

Electrophysiology of receptors, receptor potential, lateral inhibition

Electroretinogram (mention)

Duplicity theory of vision, photopic and scotopic vision

Muscles of eye

Names, nerve supply and movements of eyeball Corresponding points, double vision and squint (mention)

Colour vision

Primary, secondary and complementary colors (mention)

Hue, brightness and saturation (mention)

Receptors

Trichromatic and Opponent Process Theories

Color blobs – location and function

Color blindness

Afterimages, contrasts

-3hr

Visual pathway

Mono ocular and binocular vision

Visual signals -Processing in the Retina

Pathway -Important features to be specified at all levels (on- off mechanism and details of cellular organization in different levels not required)

Effects of lesion at different levels

Macular sparing (recent views)

Visual cortex – all areas and functions

Visual reflexes

Papillary light reflex (direct and indirect) - pathway, lesion, Miosis & mydriasis (mention)

Accommodation reflex – pathways, lesions

Corneal reflex - pathway

Tests of Vision -Field of vision, Visual acuity, Color vision – definition, details of tests in practicals

-1 $\frac{1}{2}$ hr

AUDITION

LECTURES

-4hr

Acoustics – frequency, amplitude of sound, pitch, intensity, and quality of sound

Functional anatomy of the ear

Functions of external, middle and inner ear

-1hr

Cochlea – structure, Organ of corti,

Hair cell physiology- receptor potential

Mechano-electrical transduction by hair cells

Endocochlear potential

Discrimination of pitch (travelling wave theory) and intensity of sound

-2hr

Auditory pathway

Sound localisation, pitch discrimination, masking of sounds

Deafness (conduction and nerve deafness) – tests in practicals

Audiometry (details in practicals)

-1hr

SEMINARS / TUTORIALS

-6hrs

Lacrimal apparatus and tear, Aqueous humor, intraocular pressure

Role of Vitamin A in vision
 Functions of middle and inner ear

ENDOCRINOLOGY

LECTURES

-15 hrs

General endocrinology

Names and organisation of Endocrine glands in human body Hormone – definition, and classification – on chemical nature. General hormones and local hormones – autocrine, paracrine and endocrine.hormones.

Mechanism of action of hormones. Hormone receptors – cell membrane and intracellular, Mechanism of action via the different receptors – basics with 2 examples, Second messenger system -brief

Control of secretion of hormones in general – the + ve and –ve feed back with 2 examples

Abnormalities of hormone function – decrease, increase, receptor dysfunction, abnormal hormones or antibodies

Hormonal assay – mention about RIA, ELISA (no details)

-2 hrs

Hypothalamus Functional anatomy, Hormones (Releasing and inhibiting), their physiological actions Interrelationship between hypothalamus and pituitary glands – Infundibulum -hypothalmo –pituitary tract and portal system

Pituitary gland

Functional anatomy, cell types
 Hormones of anterior and posterior pituitary

Growth hormone - physiological actions and regulation of secretion in detail

Hyper and hypofunction – Acromegaly, Gigantism and Dwarfism

Other hormones to be dealt with the target glands, Mention intermediate lobe hormones - – pro opiomelanocortin and MSH

-3 hrs

Thyroid gland

Hormones- names, biosynthesis (details in biochemistry), transport, physiological actions (physiologic, pharmacologic and pathologic) and regulation of secretion (H-P-T axis)

Thyroid function tests (details in biochemistry)

Hyper and hypofunction in children and adults – Cretinism, Myxedema, Hyperthyroidism

-2 hrs

Pancreas – endocrine

Functional anatomy, Hormones- physiological actions and regulation of secretion

Insulin - receptors and insulin resistance (mention) Physiological actions Regulation of secretion Hyper and hypofunction – diabetes mellitus and hypoglycemia

Glucagon – physiologic actions on carbohydrate, proteins and fat metabolism, on heart
Regulation of secretion

Somatostatin – site of production, actions, stimuli for secretion, paracrine regulations.

Pancreatic polypeptide – site of secretion, factors which increase secretion, actions
-2 hrs

Adrenal gland

Adrenal Cortex

Functional anatomy – 3 layers (briefly)

Biosynthesis of adrenal cortical hormones (details in biochemistry)

Hormones of adrenal cortex - glucocorticoids, mineralocorticoids, sex steroids

Transport, physiological actions and regulation of secretion

glucocorticoids -metabolic, permissive, anti inflammatory, anti allergic and in stress
Regulation of secretion – H-P-A axis

mineralocorticoids – role in salt and water balance, stress
Regulation of secretion – effects of K⁺, Na⁺, ACTH
Hyper and hypofunction – Cushings syndrome
Primary and secondary hyperaldosteronism, Addisons disease

Adrenal medulla

Hormones (catecholamines) , regulation of secretion, Pheochromocytoma -3hr

Calcium homeostasis

Normal calcium metabolism (outline)

Parathyroid hormone, calcitonin and vitaminD - target organs and physiological actions

Hypocalcemia and tetany -1hr

Other endocrine glands

Hormones, physiological actions and regulation of secretion -

Kidney

Pineal body (retino hypothalamic tract – very brief)

Thymus

Heart

Local hormones

Histamine, Sub P, bradykinin, serotonin, prostaglandins, Sources and physiological actions
-1hr

Physiology of growth and development

Correlation of actions of different hormones from childhood, puberty and adulthood (briefly)
-1hr

SEMINARS / TUTORIALS - 6hr

Calcium homeostasis : – parathormone, vitamin D and Calcitonin, Other regulating hormones

Adrenal medulla

Physiology of growth and development: Hormonal and other influences

PHYSIOLOGY OF REPRODUCTION

LECTURES

-11hr

Introduction

Sex organs, genetic basis of sex

Sex differentiation and development of Reproductive system

Briefly on factors influencing development of genitalia – hormones

Aberrant sexual differentiation

Chromosomal (Turners and Klinefelters), developmental (adrenogenital, hermaphroditism)

Puberty – normal, precocious and delayed puberty

-1hr

Male reproductive system

Functional anatomy

Functions of testis – endocrine -testosterone (functions and regulation of secretion)

- Spermatogenesis and factors influencing and regulating this Abnormalities of testicular function - cryptorchidism, male hypogonadism (mention)

Erection, ejaculation, composition of semen, sterility

-2hr

Female reproductive system

Functional anatomy

Ovary - oogenesis, ovulation, corpus luteum, ovarian hormones- estrogens, progesterone, relaxin

Control of ovarian functions by H- P- Gonadal axis

Pituitary gonadotropins (FSH, LH), Prolactin – physiologic actions, regulation of secretion

-2hr

Menstrual cycle

Menstrual, proliferative and secretory phases

Ovarian, uterine and vaginal changes during menstrual cycle

Hormonal regulation

Abnormalities of ovarian function -anovulatory cycle, infertility

Menarche, menopause

Castration before and after puberty

-2hr

Pregnancy

Fertilisation, implantation, Corpus luteum of pregnancy

Placenta – functions, Placental hormones

Foetoplacental unit

Pregnancy tests – immunological (currently done)

Parturition – physiology of labour

Lactation

Hormones influencing and their actions

-3hr

Contraception

Temporary and permanent methods in males and females, and their physiological basis

-1hr

INTEGRATED TEACHING

-4hr

Induction of ovulation, in vitro fertilization (with O &G dept)
 Infertility (with O &G dept)

DETAILS OF PRACTICALS**Human Physiology**

-76hr

1. Use and care of microscope and microscopic examination of blood
2. PCV, ESR, osmotic fragility
3. Haemoglobin estimation and blood indices
4. RBC count
5. WBC count
6. Examination of peripheral blood smear
7. Differential WBC count – normal, abnormal, anaemias
8. ABO grouping, Rh typing
9. Bleeding time, clotting time
10. Recording of BP – effects of posture and exercise
11. Recording of arterial pulse only
12. Respiratory movements demonstration
12. General examination
13. Examination of Respiratory system
14. Examination of CVS
- 15 Examination of higher functions and sensory system
- 16 Examination of Motor system
17. Examination reflexes
18. Examination of cranial nerves 1-6
19. Examination of cranial nerves 7-12
20. Revisions as required (38 hrs)

Experimental physiology

-28hr

1. Appliances in experimental physiology Laboratory including physiograph
2. Pithing, muscle nerve preparation, mounting, effects of different types of stimuli
3. Simple muscle twitch
4. Two successive stimuli, repetitive stimuli and fatigue
5. Genesis of tetanus and Starling's law of muscle (demonstration)
6. Effect of load and after load on muscle contraction
7. Effects of variations of temperature on muscle contraction
8. Velocity of nerve impulse (demonstration)
9. Normal cardiogram of frog's heart and effects of heat and cold.
10. Effect of temperature on frog's heart
11. Refractory period of frog's heart
12. Stannius ligatures. Properties of cardiac muscle – all or none law, treppe, summation of subminimal stimuli (demonstration)
13. Effect of vagal stimulation on frog's heart
14. Perfusion of frog's heart – action of ions, action of drugs
 (Nos. 4 to 8 & 10 to 14 – demonstration through e-modules/recorded graphs)

DEMONSTRATE SIMPLE MUSCLE TWITCH and NORMAL CARDIOGRAM

Others can be demonstrated with e- modules / recorded graph

Demonstrations (with e- modules / recorded graph/ clinical postings) -16hrs

I. Mammalian experiments

1. Heart perfusion

2. Intestinal movements

II. Biopotentials on Oscilloscope

Electro encephalogram (EEG), Electro miogram (EMG), Electro Cardio Gram (ECG),

III. Audiometry, Perimetry, Spirometry

Recommended Text Books**Prescribed Books**

1. Text book medical physiology – Arthur C. Guyton: W.B. Saunders

2. Review of Medical Physiology – W.F. Ganong – Lange Medical Book ed. 22nd.

3. Understanding Medical Physiology. R.I. Bijalani Jaypee Publishers

4. Best and Taylor's physiologic basis of medical practice J B West (edn) William and Walkins

Reference Books

1. Text book of Human Physiology. Madhavan Kutty, Sarada Subramaniam, HD Sing, S. Chand and Company

2. Wintrobe's Hematology

3. Williams text book of Endocrinology

4. Snell's neuroanatomy

EVALUATION

M.C.I. Guidelines

o Problem solving exercises

o OSPE (Objective Structured Practical Examination)

o Records – review

o Viva Voce – with practicals

o Written case scenario

University Examination	Marks
Theory Paper I, II	50+50=100
Internal Assessment	20
Practicals I, II	20+20= 40
Internal Assessment	20
Viva Voce	20
Total	200

Internal Assessment	
Based on day to day performance assessed by daily evaluation, short examinations, tutorials,	
seminars, sessional examinations etc.	
Theory – Pattern of Question paper - Two papers of three hours duration	(50 marks each)

MODEL QUESTION PAPER

First Professional MBBS Degree Examination Paper - I PHYSIOLOGY

Time: 3 hrs

Max marks: 50

Instructions:

Draw diagrams wherever necessary

Answer all questions.

1. A 40 years old obese women complained of repeated attacks of right hypochondrial pain and yellow coloration of eyes. Her serum bilirubin -15mg/dl Vanderberg test was direct positive and serum alkaline phosphatase was 50 IU.

- Give the most appropriate name of this clinical condition.
- What is the life span of RBC and how do you measure it?
- List the steps of breakdown of Haemoglobin

(1+3+6=10 marks)

Short Essay:

2. Discuss the factors affecting Glomerular Filtration Rate. Mention one abnormal condition when GFR is decreased

(4+1=5 marks)

3. Explain the transport of Carbondioxide in blood

(5 marks)

Write briefly on:

4. Function of Large intestine
5. Gastric emptying
6. Formation and functions of Lymph
7. Micturition Reflex
8. Role of Hypothalamus in Temperature regulation

(5x3=15 marks)

Draw and label:

9. Normal E C G in Lead II
10. Juxtaglomerular apparatus

(2x2½ =5 marks)

Explain the physiological basis of the following:

11. Post prandial alkaline tide
12. Clotting of blood does not occur In-vivo normally
13. Coronary arteries are perfused during diastole
14. Hypersmolarity of renal medullary interstium
15. Lung alveoli are kept dry normally

(5x2=10 marks)**MODEL QUESTION PAPER**

**First Professional MBBS Degree Examination
Paper - II PHYSIOLOGY**

Time: 3 hrs**Max marks: 50*****Instructions:***

*Draw diagrams wherever necessary
Answer all questions.*

1. A 60 year old man was brought to the casualty with the complaints of sudden onset of inability to move his right upper limb and lower limb. He gave a history of treatment for hypertension since 10 years. On examination he presented with Hemiplegia with UMN facial nerve palsy of the right side

- Name the tract affected in this patient
- Mention the most probable site of lesion
- Trace the affected pathway with the help of a diagram
- State the differentiating features of Upper Motor Neurons and Lower Motor Neuron lesions
- Comment on the tone of the muscles of the affected side

(1+1+4+2+2=10 marks)**Short Essay:**

2. Give an account of visual pathway. What is the effect of a lesion of right optic tract?
3. Discuss the hormonal regulation of blood calcium level

(2x5=10 marks)**Write briefly on:**

4. Pathway of pain from the face
5. Theories of hearing
6. Role of nigrostrial pathway in regulating cortical activity
7. Hormonal control of lactation
8. Second Messengers

(5x3=15 marks)**Draw and label:**

9. Organ of Corti
10. Hormonal changes during normal menstrual cycle.

(2x2½ =5 marks)

Write short notes on:

11. Actions of aldosterone
12. Impedence matching
13. Functions of sertoli cells
14. Sarcomere
15. Pre Synaptic Inhibition

(5x2=10 marks)

9.4 FORENSIC MEDICINE AND TOXICOLOGY**GOAL**

The broad goal of the teaching of undergraduate students in Forensic medicine is to produce a physician who is well informed about medico legal responsibilities in practice of medicine. He/she acquire knowledge of law in relation to medical practice, medical negligence and respect for codes of medical ethics.

Learning objectives-

1. Be conversant with medical ethics, etiquette, duties rights and legal responsibilities of the physician towards patients, profession, society, state and humanity at large and implications of medical negligence.
2. Be aware of relevant existing laws and procedures including the recent developments applicable to medical practice.
3. Identify, examine, document and prepare report/certificate in medico legal cases/situations in accordance with the law of the land.
4. Recognize and manage common medico legal problems including cases of poisoning in conformity with the medical procedure.
5. Perform medico legal postmortem examination and interpret the findings and results of other relevant investigations to logically conclude the cause, manner and time since death.
6. Preserve and dispatch specimens in medico legal/postmortem cases and other concerned materials to the appropriate government agencies for necessary examination.
7. Be aware of the general principles of environmental, occupational and preventive aspects of toxicology.

Period of study	-	III, IV and V Semester.
Duration of training	-	18 months.
Methods of instructions	-	
Lecture	-	30 hrs.
Practicals and Innovative sessions-		70 hrs.
Total no of hours	-	100Hrs.

	TOPIC	Method of teaching	Hours
	Forensic medicine	Lecture	1
1	Definition of forensic medicine, Forensic pathology and medical jurisprudence		
2	Introduction to the subject, historical aspects of forensic medicine.		
3	Inquest procedures	Lecture	3
4	Courts in India and their powers. Supreme court, High court, Sessions court, Assistant sessions court and Magistrate courts.	Innovative session (Moot court) Practical	2
5	Court procedures. Summons, warrant, Conduct money, Oath/affirmation, Types of witnesses, Recording of evidence, Conduct of doctor in witness box, Perjury, Hostile witness.		2
6	Medical certificates and Medico legal reports. Birth, death, wound, drunkenness, potency, offence cases, intimation, notification.	Lecture	1
7	Death sex	Lecture	4
8	Definition, diagnosis and certification (as per MCCD rules), somatic, molecular and brain death. Sudden natural deaths, suspended animation. Changes after death. A) Algor mortis, Livor mortis, Rigor mortis, cadaveric spasm, cold stiffening, heat stiffening. B) Decomposition, modified forms of decomposition, estimation of time since death. C) Common post mortem artifacts.	Practical demo.	4

	<p>F) Injuries due to traffic occurrences.</p> <p>G) Injuries due to physical agents and their medico legal importance: Heat, cold electricity and lightning. Explosion injuries.</p>	Innovative (Project)	4
12.	<p>Asphyxial deaths: Definition, causes, types, postmortem appearances and medico legal significance of violent asphyxia deaths like hanging, strangulation, suffocation, smothering, choking, drowning, traumatic asphyxia.</p>	Lecture Innovative (Gp.discn)	4 2
13	medico legal aspects of Deaths due to starvation-forced feeding.	Practical	4
	Human sexual functions:	Lecture	2
14	<p>A). Potency, sterility, virginity, pregnancy, delivery.</p> <p>B) Abortion, MTP, sexual sterilization, artificial insemination and their legal aspects.</p> <p>C) Sexual offences and abnormal sexual practices.</p> <p>D) Legal aspects of the above.</p>	Lecture Innovative (Gp.discn) Lecture Practical	3 2 1 2

	<p>ethics in medical practice.</p> <p>D) Professional secrecy and privileged communication.</p> <p>E) Medical negligence: Civil, criminal, contributory negligence, vicarious responsibility, res ipsa loquitur, prevention of medical negligence and defence in medical negligence suits.</p> <p>F) Consent; Types, age in relation to consent, consent in relation to mental illness and alcohol intoxication, consent in emergency situations.</p> <p>G) Consumer protection act.</p> <p>H) Certification of births, deaths, illness, fitness, disability.</p>	Innovative (Seminar)	
19.	<p>Forensic toxicology:</p> <p>A) Definition and general principles of management of a case of poisoning.</p> <p>B) Medico legal duties of a doctor in a case of poisoning, preservation and dispatch of viscera for chemical analysis. Role of chemical examiner's laboratory and forensic science laboratory in brief.</p> <p>C) Diagnosis and principles of therapy and medico legal aspects of the following poisons, giving special emphasis to those of regional importance</p> <p>-a) Corrosive poisons: strong mineral acids, alkalis and organic acids-(carbolic, formic and oxalic acid).</p> <p>b) Metallic poisons: Lead, Arsenic, and Iron.</p> <p>c) Animal poisons-snake and scorpion</p>	Lecture Innovative (Seminar) Innovative Integration Pharmacology	2 5 4

	<p>bites.</p> <p>d) Deliriant: Dhatura, Cannabis and Cocaine.</p> <p>e) Inebriants: Methyl and Ethyl alcohol.</p> <p>f) Asphyxiants: Carbon monoxide, carbon dioxide, Hydrogen sulphide and Cyanides.</p> <p>g) Cardiac poisons: Cerbera odollam, Cerbera thevitia, Nerium odorum.</p> <p>h) Insecticides: Organophosphorous compounds, Carbamates and Organochloro compounds, Aluminium phosphide and Zinc phosphide.</p> <p>D) Drug abuse and dependence.</p> <p>E) Inorganic non metallic poisons: Phosphorous.</p> <p>F) Organic vegetable irritants: Abrus precatorius, capsicum, calotropis, Semicarpus anacardium, Croton.</p> <p>G) Convulsants: Strychnine.</p> <p>H) Paralytic agents: Curare.</p> <p>I) War gases and industrial gases.</p> <p>J) Chloral hydrate.</p> <p>K) Mechanical poisons.</p>	<p>Practical</p> <p>Innovative</p> <p>(Gp.discn)</p>	
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SKILLS		Level of achievement			
		Able to perform independently	Able to perform under guidance	Assist	Observe
1.	Prepare certificates of birth and death.			1	
2.	Prepare dying declaration.			2	
3.	Give evidence in court of law as expert witness.				3
4.	Collect, preserve and properly label and dispatch specimens of medico legal importance.	4			
5.	Diagnose and manage common acute and chronic poisoning.		5		
6.	Perform medico legal duties in case of poisoning.		6		
7.	Observe ten medico legal autopsies and enter in practical record.				7
8.	Age estimation from bones, skiagrams and dentition	8			
9.	Examination of injuries and weapons and report writing.	9			
10.	Examination of an alcohol intoxicated person and report writing.	10			
11.	Examination of victim and accused in sexual offence cases.	11			
12.	Study of specimens of poisons.	12			
13.	Study of wet and models, charts etc.dry specimens,	13			

Suggested topics for integrated teaching

1. Examination of injured person and report writing. Integration with surgery casualty posting.
2. Examination of victim of sexual assault cases and report writing. Integration with casualty management posting.
3. Forensic psychiatry. Integration with psychiatry posting.

4. Management of cases of poisoning. Integration with medicine.
5. Drug abuse and drug dependence. Integration with pharmacology.

Suggested topics for e-learning

1. Ethical and medico legal issues in clinical practice.
2. Child abuse.
3. HIV/AIDS.
4. Torture medicine.
5. Lie detection.
6. Narco analysis.
7. Brain finger printing

Prescribed books

1. Practical Forensic medicine. B.Umadethan, CBS publishers & distributors.
2. Forensic medicine, P.V. Guharaj, 2nd Edition, University press.
3. Text book of Forensic medicine and Toxicology-principles and Practice, Krishan Vij, 4th Edition, Elsevier

Reference books

1. Essentials of Forensic medicine and toxicology. K.S. Narayana Reddy, 29th Edition.
2. Modis text book of Medical Jurisprudence and Toxicology, 23rd Edition, Lexis Nexis.
3. Text Book of Forensic medicine and Toxicology by Nagesh Kumar G.Rao, 2nd Edition. Jaypee brothers Medical Publishers
4. Principles and practice of Forensic medicine. Dr.B. Umadethan 2008, Swami Law Publishers.
5. Parikhs Text Book of Medical Jurisprudence, forensic medicine and Toxicology, 6th edition, CBS Publishers and Distributors.
7. J.B. Mukherjee's forensic medicine and Toxicology. R.N. Karmakar 2007.

Evaluation

Internal assessment examinations may be conducted as per the discretion. examination per semester, without violating MCI norms. : Minimum one

Theory

Section A	20
Section B	20
Internal assessment	10
Total	50

Practicals	30
Internal assessment	10
Viva	10
Total	50
Grant total	100

Topics and mark allotment

Medical jurisprudence	20%
Court and legal procedures	10%
Thanatology, M/L autopsy	8%
Asphyxial deaths	10%
Traumatology	10%
Sexual jurisprudence	20%
Infanticide	10%
Trace evidences	5%
Forensic psychiatry	2%
Toxicology	5%

Practical Examination (Total Marks-30)

Exercise.No.1 -8 Spotters (each carrying 1 mark, Total 8 Marks)

Exercise.No.2 -Perusing the postmortem findings & answering questions in writing
(7 marks)

Exercise No.3 -Wound certification by perusing the data given& answering the question.
(8 Marks)

Exercise No.4 -Certification of sexual offence/Potency/Drunkenness and answering the questions by perusing the data.
(7 Marks)

Exercise Nos. (1), (2), (3) & (4) will be common for all candidates appearing on the same day but the selection of the question for exercise no.4 will be done by the concerned examiner on each day.

9.5 MICROBIOLOGY**A. GOAL**

The broad goal of the teaching of undergraduate students in Microbiology is to provide an understanding of the natural history of infectious diseases in order to deal with the etiology, pathogenesis, laboratory diagnosis, treatment and control of infections in the community.

B.OBJECTIVES**1. Knowledge**

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

- i. State the infective microorganisms of the human body and describe the host parasite relationship
- ii. List pathogenic microorganisms (bacteria, viruses, parasites, fungi) and describe the pathogenesis of the diseases produced by them
- iii. State or indicate the mode of transmission of pathogenic and opportunistic organisms and their sources including insect vectors responsible for transmission of infection
- iv. Describe mechanisms of immunity to infections
- v. Acquire knowledge on suitable antimicrobial agents for treatment of infections and scope for immunotherapy and different vaccines available for prevention of communicable diseases
- vi. Apply methods of disinfection and sterilization to control and prevent hospital and community acquired infections
- vii. Recommend laboratory investigations regarding bacteriological examination of food, water, milk and air.

2. Skills

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

1. Plan and interpret laboratory investigations for the diagnosis of infectious diseases and to correlate the clinical manifestations with the etiological agent

2. Identify the common infectious agents with the help of laboratory tests and determine the efficacy of antimicrobial agents against them.
3. Perform commonly employed bedside tests for detection of infectious agents such as blood film for malaria, filaria, gram staining, Acid Fast Bacilli (AFB) staining and stool sample of ova cyst etc.
4. Use the correct method for collection, storage, and transport of clinical specimens for microbiological investigations

3. Integration

The student shall understand infectious diseases of national importance in relation to clinical, therapeutic and preventive aspects

C. DETAILED SYLLABUS DETAILS OF THE COURSE

Duration of the course: 3 semesters-III, IV, V Total Number of Hours: 250 Lectures: 80 Practicals: 80 Innovative sessions: 90 (Project work, Seminars, Structures discussions, Integrated teaching, Formative evaluation, revision)

(The teaching should stress on Pathogenesis, Laboratory diagnosis, sterilization and disinfection, infectious diseases common in Kerala and India, Hospital infection, antibiotic use, Principles of immune prophylaxis and immunotherapy and applied and clinical microbiology. Certain portions to be

Deleted—Detailed morphological, cultural, Biochemistry, and Antigenic characters, detailed life cycle of parasites)

DETAILS OF LECTURES	80 hrs
1.General microbiology	12 hrs
1. Introduction to microbiology	
2. Morphology of bacteria comparison with other microbial forms	
3. Growth, nutrition culture media	
4. Identification of bacteria	
5. Bacterial genetics	
6. Antibacterial agents and antibiotic sensitivity test	
7. Infection-Source and spread of infection	
8. Sterilisation and disinfection	
9. Response to microbial infections	

II. Systematic bacteriology	25 hrs
1. Gram positive Cocci-Staphylococci, Streptococci, Pneumococci	
2. Gram negative Cocci-Neisseria	
3. Gram Positive Bacilli-Corynebacterium, Listeria, Bacillus	
4. Mycobacteria, Nocardia, Actinomyces	
5. Clostridia, Nonsporing anaerobes.	
6. Gram negative Bacillus-Haemophilus, Bordetella, Brucella, Enterobacteria/Yersinia	
7. Pseudomonas, Pasteurella, Acinetobacter	
8. Vibrio/Campylobacter	
9. Mycoplasma, Legionella, Rickettsia, Chlamydia	
10. Spirochetes	
III. Virology	15 hrs
1. General characteristics of viruses.	
2. Virus host interaction	
3. Replication of virus	
4. Pox virus, Herpes, Adenovirus	
5. Papova, Retrovirus	
6. Myxoviruses	
7. Picorna virus	
8. Hepatitis, Miscellaneous	
9. Rhabdo virus	
10. Arboviruses	
11. Oncogenic viruses	

12. Bacteriophages	
IV.Immunology	12hrs
1. Introduction Classification, type and cells involved in immunity	
2. Antigen, Antibodies	
3. Complement in health and diseases	
4. Hypersensitivity	
5. HLA antigens in health and diseases	
6. Immunodeficiency diseases	
7. Serological test in medical practice	
8. Auto immunity	
9. Tumour and transplantation	
10. Immunoprophylaxis and immunotherapy	
V.Parasitology (Topic presentation)	12 hrs
1. Introduction of parasitic disease	
2. Protozoal infections-Amoebiasis, Plasmodium,Leishmaniasis, Trypanosoma, Giardia, Balantidium, Cryptosporidium, Trichomonas, Toxoplasma, Pneumocystis-laboratory diagnosis of protozoal infection	
3. Helminthus-intestinal nematodes, tissue nematodes,cestodes, trematodes-Laboratory diagnosis of helminthic infections	
VI.Mycology	4 hrs
1. Introduction-Classification of fungi and general principles of lab diagnosis	
2. Superficial infections	
3. Subcutaneous infections-Mycetoma, Rhinosporidiosis	

4. Systematic mycosis	
5. Opportunistic fungi	
DETAILS OF PRACTICALS AND DEMONSTRATION	40 hrs
1. Techniques Simple stain, Gram Stain, Ziehl –Neelsen stain,	
Fungus Lactophenol cotton blue,	
Parasitology stool examination	
2. Clinical microbiology (Demonstration cum practical)	60hrs
a.	Oropharyngeal infection
b.	Wound infection
c.	Respiratory tract infections
d.	Meningitis
e.	Gastro intestinal infections
f.	Urinary tract infections
g.	Urethritis
h.	Blood culture techniques
i.	Equipments/Instruments
j.	Interpretation of lab results

APPLIED MICROBIOLOGY (Discussion and Integrated teaching)

60hrs

1. Upper respiratory tract infections, infections of eye and ear
2. Pneumonia, Tuberculosis, Bronchitis-Aetiology, lab diagnosis, Prophylaxis
3. Rheumatic fever-Endocarditis, Myocarditis
4. Urinary tract infections
5. Enteric fever-P.U.O
6. Gastroenteritis-Cholera, other causes
7. Osteomyelitis-Arthritis, TB of bone
8. Meningitis, Pyogenic, Aseptic

9. Opportunistic infections
10. Sexually transmitted diseases
11. Hospital infections
12. Antimicrobial agents

TUTORIAL

10hrs

1. Normal flora
2. Anaerobic infections
3. Collection, transportation and preliminary processing of specimens
4. Laboratory diagnosis of viral infections
5. Investigations of epidemics in the hospital and community

TEXTBOOKS**RECOMMENDED Prescribed****Books**

1. Textbook of Microbiology by R. Anantha Narayanan and C.K.J. Paniker 7th Edition Orient Longman
2. A guide to Microbial Infections, Pathogenesis, Immunology, Laboratory diagnosis and Control by Greenwood. Slack and Penthera
3. Textbook of Parasitology by C. K. J. Paniker / Chakraborty / Baveja / Pareja
4. Textbook of Parasitology by Chatterjee.

Reference Books

1. Microbiology in clinical practice by Shanson
2. Medical Microbiology by Jawetz E, Melnick J L, Adelberg E A
3. Textbook of Immunology-Roitt
4. Diagnostic Microbiology by Koneman

EVALUATION: Microbiology-Two papers of 2 hour duration of 40 marks each**Microbiology paper I-General bacteriology, Immunology, & systematic bacteriology.**

Structured Essay = 10 marks
Short Essays (2 X5) = 10 marks
Short answer questions (10 X2) = 20 marks

Total = 40 marks**Microbiology paper II-Virology, Parasitology, Mycology, Clinical Microbiology**

Structured Essay = 10 marks
Short Essays (2 X5) = 10 marks
Short answer questions (10 X2) = 20 marks

Total = 40 marks**Total marks (40 + 40) = 80 marks**

98

Internal assessment = 15 marks

Viva voce = 15 marks

Total for theory = 110 marks

Practical = 25 marks

Internal assessment = 15marks

Total for practical = 40 marks

Total for the subject = 150marks

(Duplication of the questions should be avoided)

Practicals

Total marks : 25 marks

1. Gram staining (Clinical material) – 5marks

2. AFB staining (Clinical Material) – 5 marks

3. Applied microbiology – 5 marks

4. Spotters-10 numbers – 10 marks

2 minutes for each spotter, 2-4 subquestions with each spotter.

*(2 Mycology, 3 Parasitology, 2 General Bacteriology, 2 Virology/Immunology
& 1 Clinical Bacteriology)*

Oral

15 marks