Preamble

The Medical Council of India visualized that the Indian Medical Graduate, at the end of the undergraduate training program, should be able to recognize "health for all" as a national goal and should be able to fulfill his/her societal obligations towards the realization of this goal. To fulfill the mandate of the undergraduate medical curriculum which is to produce a clinician, who understands and is able to provide preventive, promotive, curative, palliative and holistic care to his patients, the curriculum must enunciate clearly the competencies the student must be imparted and must have learnt, with clearly defined teaching-learning strategies and effective methods of assessment.

More than twenty years have passed since the existing Regulations on Graduate Medical Education, 1997 was notified, necessitating a relook at all aspects of the various components in the existing regulations and adapt them to the changing demography, socio-economic context, perceptions, values and expectations of stakeholders. Emerging health care issues particularly in the context of emerging diseases, impact of advances in science and technology and shorter distances on diseases and their management also need consideration. The strong and forward looking fundamentals enshrined in the Regulations on Graduate Medical Education, 1997 has made this job easier. A comparison between the 1997 Regulations and proposed Graduate Medical Education Regulations, 2018 will reveal that the 2018 Regulations have evolved from several key principles enshrined in the 1997 Regulations.

The thrust in the new regulations is continuation and evolution of thought in medical education making it more learner-centric, patient-centric, gendersensitive, outcome -oriented and environment appropriate. The result is an outcome driven curriculum which conforms to global trends.

Competency based Medical Education provides an effective outcome-based strategy where various domains of teaching including teaching learning methods and assessment form the framework of competencies. Keeping this objective as the core ingredient, the Medical Council of India with the help of panel of experts drawn from across the country, laid the basic framework for the revised undergraduate medical curriculum which shall be implemented from 2019-20.

The syllabus / curriculum shall also be effective for the students admitted to Phase I of MBBS Degree course (Revised) in the constituent college of the KAHER viz., J.N. Medical College, Belagavi from the academic session 2019-20 onwards.

Regulations of Graduate Medical Education
As per Gazette of India No. 390

(Amendment 4th November 2019)

GENERAL CONSIDERATIONS AND TEACHING APPROACH

1. The provisions contained in these Regulations shall apply to the MBBS course starting from academic year 2019-20 onwards

2. Indian Medical Graduate Training Programme

The undergraduate medical education programme is designed with a goal to create an "Indian Medical Graduate" (IMG) possessing requisite knowledge, skills, attitudes, values and responsiveness, so that she or he may function appropriately and effectively as a physician of first contact of the community while being globally relevant. To achieve this, the following national and institutional goals for the learner of the Indian Medical Graduate training programme are hereby prescribed:-

2.1. National Goals

At the end of undergraduate program, the Indian Medical Graduate should be able to:

(a) Recognize "health for all" as a national goal and health right of all citizens and by undergoing training for medical profession to fulfill his/her social obligations towards realization of this goal.

(b) Learn every aspect of National policies on health and devote her/ him 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 observance of medical ethics and fulfilling social and professional obligations, so as to respond to national aspirations.

2.2. Institutional Goals

(1) 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 Indian Medical Graduates 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, palliative and rehabilitative medicine in respect to the commonly encountered health problems.

(c) appreciate rationale for different therapeutic modalities; be familiar with the administration of "essential medicines" and their common adverse effects.

(d) be able to appreciate the socio-psychological, cultural, economic and environmental factors affecting health and develop humane 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:

(i) Family Welfare and Maternal and Child Health (MCH)

(ii) Sanitation and water supply

(iii) Prevention and control of communicable and non-communicable diseases

(iv) Immunization

(v) Health Education

(vi) Indian Public Health Standards (IPHS), at various levels of service delivery

(vii) Bio-medical waste disposal

(viii) Organizational and/or institutional arrangements.

(g) acquire basic management skills in the area of human resources, materials and resource management related to health care delivery, hospital management, inventory skills and counseling.

(h) be able to identify community health problems and learn to work to resolve these by designing, instituting corrective steps and evaluating outcome of such measures.

(i) be able to work as a leading partner in health care teams and acquire proficiency in communication skills.

(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.

(2) All efforts must be made to equip the medical graduate to acquire the skills as detailed in Table 11 Certifiable procedural skills – A Comprehensive list of skills recommended as desirable for Bachelor of Medicine and Bachelor of Surgery (MBBS) – Indian Medical Graduate.

2.3. Goals and Roles for the Learner

In order to fulfil the goal of the IMG training programme, the medical graduate must be able to function in the following roles appropriately and effectively:-

2.3.1. Clinician who understands and provides preventive, promotive, curative, palliative and holistic care with compassion.

2.3.2. Leader and member of the health care team and system with capabilities to collect analyze, synthesize and communicate health data appropriately.

2.3.3. Communicator with patients, families, colleagues and community.

2.3.4. Lifelong learner committed to continuous improvement of skills and knowledge.

2.3.5. Professional, who is committed to excellence, is ethical, responsive and accountable to patients, community and profession.

3. Competency Based Training Programme of the Indian Medical Graduate

Competency based learning would include designing and implementing medical education curriculum that focuses on the desired and observable ability in real life situations. In order to effectively fulfil the roles as listed in clause 2, the Indian Medical Graduate would have obtained the following set of competencies at the time of graduation:

3.1. Clinician, who understands and provides preventive, promotive, curative, palliative *and holistic care with compassion*

3.1.1 Demonstrate knowledge of normal human structure, function and development from a molecular, cellular, biologic, clinical, behavioural and social perspective.

3.1.2. Demonstrate knowledge of abnormal human structure, function and development from a molecular, cellular, biological, clinical, behavioural and social perspective.

3.1.3 Demonstrate knowledge of medico-legal, societal, ethical and humanitarian principles that influence health care.

3.1.4 Demonstrate knowledge of national and regional health care policies including the National Health Mission that incorporates National Rural Health Mission (NRHM) and National Urban Health Mission (NUHM), frameworks, economics and systems that

influence health promotion, health care delivery, disease prevention, effectiveness, responsiveness, quality and patient safety.

3.1.5. Demonstrate ability to elicit and record from the patient, and other relevant sources including relatives and caregivers, a history that is complete and relevant to disease identification, disease prevention and health promotion.

3.1.6. Demonstrate ability to elicit and record from the patient, and other relevant sources including relatives and caregivers, a history that is contextual to gender, age, vulnerability, social and economic status, patient preferences, beliefs and values.

3.1.7 Demonstrate ability to perform a physical examination that is complete and relevant to disease identification, disease prevention and health promotion.

3.1.8 Demonstrate ability to perform a physical examination that is contextual to gender, social and economic status, patient preferences and values.

3.1.9 Demonstrate effective clinical problem solving, judgment and ability to interpret and integrate available data in order to address patient problems, generate differential diagnoses and develop individualized management plans that include preventive, promotive and therapeutic goals.

3.1.10 Maintain accurate, clear and appropriate record of the patient in conformation with legal and administrative frame works.

3.1.11 Demonstrate ability to choose the appropriate diagnostic tests and interpret these tests based on scientific validity, cost effectiveness and clinical context.

3.1.12 Demonstrate ability to prescribe and safely administer appropriate therapies including nutritional interventions, pharmacotherapy and interventions based on the principles of rational drug therapy, scientific validity, evidence and cost that conform to established national and regional health programmes and policies for the following:

(i) Disease prevention,

(ii) Health promotion and cure,

(iii) Pain and distress alleviation, and

(iv) Rehabilitation.

3.1.13 Demonstrate ability to provide a continuum of care at the primary and/or secondary level that addresses chronicity, mental and physical disability.

3.1.14 Demonstrate ability to appropriately identify and refer patients who may require specialized or advanced tertiary care.

3.1.15 Demonstrate familiarity with basic, clinical and translational research as it applies to the care of the patient.

3.2. *Leader and member of the health care team and system*

3.2.1 Work effectively and appropriately with colleagues in an inter-professional health care team respecting diversity of roles, responsibilities and competencies of other professionals.

3.2.2 Recognize and function effectively, responsibly and appropriately as a health care team leader in primary and secondary health care settings.

3.2.3 Educate and motivate other members of the team and work in a collaborative and collegial fashion that will help maximize the health care delivery potential of the team.

3.2.4 Access and utilize components of the health care system and health delivery in a manner that is appropriate, cost effective, fair and in compliance with the national health care priorities and policies, as well as be able to collect, analyze and utilize health data.

3.2.5 Participate appropriately and effectively in measures that will advance quality of health care and patient safety within the health care system.

3.2.6 Recognize and advocate health promotion, disease prevention and health care quality improvement through prevention and early recognition: in a) life style diseases and b) cancers, in collaboration with other members of the health care team.

3.3. Communicator with patients, families, colleagues and community

3.3.1 Demonstrate ability to communicate adequately, sensitively, effectively and respectfully with patients in a language that the patient understands and in a manner that will improve patient satisfaction and health care outcomes.

3.3.2 Demonstrate ability to establish professional relationships with patients and families that are positive, understanding, humane, ethical, empathetic, and trustworthy.

3.3.3 Demonstrate ability to communicate with patients in a manner respectful of patient's preferences, values, prior experience, beliefs, confidentiality and privacy.

3.3.4 Demonstrate ability to communicate with patients, colleagues and families in a manner that encourages participation and shared decision-making.

3.4. Lifelong learner committed to continuous improvement of skills and knowledge

3.4.1. Demonstrate ability to perform an objective self-assessment of knowledge and skills, continue learning, refine existing skills and acquire new skills.

3.4.2. Demonstrate ability to apply newly gained knowledge or skills to the care of the patient.

3.4.3. Demonstrate ability to introspect and utilize experiences, to enhance personal and professional growth and learning.

3.4.4. Demonstrate ability to search (including through electronic means), and critically evaluate the medical literature and apply the information in the care of the patient.

3.4.5. Be able to identify and select an appropriate career pathway that is professionally rewarding and personally fulfilling.

3.5. Professional who is committed to excellence, is ethical, responsive and accountable to patients, community and the profession

3.5.1. Practice selflessness, integrity, responsibility, accountability and respect.

3.5.2. Respect and maintain professional boundaries between patients, colleagues and society.

3.5.3. Demonstrate ability to recognize and manage ethical and professional conflicts.

3.5.4. Abide by prescribed ethical and legal codes of conduct and practice.

3.5.5. Demonstrate a commitment to the growth of the medical profession as a whole.

4. Broad Outline on training format

4.1. In order to ensure that training is in alignment with the goals and competencies listed in sub-clause 2 and 3 above:

4.1.1 There shall be a "Foundation Course" to orient medical learners to MBBS programme, and provide them with requisite knowledge, communication (including electronic), technical and language skills.

4.1.2 The curricular contents shall be vertically and horizontally aligned and integrated to the maximum extent possible in order to enhance learner's interest and eliminate redundancy and overlap.

4.1.3. Teaching-learning methods shall be learner centric and shall predominantly include small group learning, interactive teaching methods and case based learning.

4.1.4. Clinical training shall emphasize early clinical exposure, skill acquisition, certification in essential skills; community/primary/ secondary care-based learning experiences and emergencies.

4.1.5. Training shall primarily focus on preventive and community based

approaches to health and disease, with specific emphasis on national health priorities such as family welfare, communicable and non- communicable diseases including cancer, epidemics and disaster management.

4.1.6. Acquisition and certification of skills shall be through experiences in patient care, diagnostic and skill laboratories.

4.1.7. The development of ethical values and overall professional growth as integral part of curriculum shall be emphasized through a structured longitudinal and dedicated programme on professional development including attitude, ethics and communication.

4.1.8. Progress of the medical learner shall be documented through structured periodic assessment that includes formative and summative assessments. Logs of skill-based training shall be also maintained.

4.2. Appropriate Faculty Development Programmes shall be conducted regularly by institutions to facilitate medical teachers at all levels to continuously update their professional and teaching skills, and align their teaching skills to curricular objectives.

Admission To Indian Medical Graduate Programme: National Eligibility-cum- Entrance Test And Common Counselling

5. Admission to the Indian Medical Graduate Programme

Admission to the Medical Course - Eligibility Criteria : No Candidate shall be allowed to be admitted to the Medical Curriculum of first Bachelor of Medicine and Bachelor of Surgery (MBBS) Course until:

(1) He/she shall complete the age of 17 years on or before 31st December of

the year of admission to the MBBS Course.

Procedure for selection to MBBS course shall be as follows:-

(i) In case of admission on the basis of qualifying examination under clause (1) based on merit, candidate for admission to MBBS course must have passed in the subjects of Physics, Chemistry, Biology/Bio-technology & English individually and must have

obtained a minimum of 50% marks taken together in Physics, Chemistry and Biology/ Bio-technology at the qualifying examination

There shall be a single eligibility cum entrance examination namely 'National Eligibility-cum-Entrance Test for admission to MBBS course' in each academic year. The overall superintendence, direction and control of National Eligibilitycum-Entrance Test shall vest with Medical Council of India.

The reservation of seats in medical colleges for respective categories shall be as per applicable laws prevailing in States/ Union Territories. An all India merit list as well as State-wise merit list of the eligible candidates shall be prepared on the basis of the marks obtained in National Eligibility-cum- Entrance Test and candidates shall be admitted to MBBS course from the said lists only.

All admissions to MBBS course within the respective categories shall be based solely on marks obtained in the National Eligibility-cum-Entrance Test."

6. Migration

(1) Migration of students from one medical college to another medical college in India shall be granted only in exceptional cases to the most deserving among the applicants for good and sufficient reasons and not on routine grounds. The number of students migrating to/from any one medical college shall be kept to the minimum which shall in any case not exceed the limit of 5% of its sanctioned intake in one academic year. There shall be no migration on any ground from one medical college to another located in the same city.

(2) Migration of students from one College to another is permissible only if both the colleges are recognised by the Central Government under section 11(2) of the Indian Medical Council Act, 1956 and further subject to the condition that it shall not result in increase in the sanctioned intake capacity for the academic year concerned in respect of the receiving medical college.

(3) The applicant candidate shall be eligible to apply for migration only after qualifying in the first professional MBBS examination. Migration during clinical course of study shall not be allowed on any ground.

(4) For the purpose of migration, an applicant candidate shall first obtain 'No Objection Certificates' from the college where he is studying for the present, the University to which it is affiliated to, the college to which migration is sought

and the University to which that college is affiliated to. He shall submit his application for migration within a period of one month of passing (declaration of results) of the first professional MBBS examination alongwith the said 'No Objection Certificates' to the Director, Medical Education of the State where the College/Institutions including Deemed Universities to which migration is sought is situated or to the Head of the Institution in case migration is sought to a Central Government institution. The Director, Medical Education of the State concerned or the Head of the Central Government institution, as the case may be, shall take a final decision in the matter as to whether or not to allow migration in accordance with the provisions of these Regulations and communicate the same to the applicant student within a period of one month from the date of receipt of the request for migration.

(5) A student who has joined another college on migration shall be eligible to appear in the IInd professional MBBS examination only after attaining the minimum attendance in that college in the subjects, lectures, seminars etc. required for appearing in the examination prescribed under

Regulation 12(1)

Note-1: The State Governments/Universities/Institutions may frame appropriate guidelines for grant of No Objection Certificate or migration, as the case may be, to the students subject to provisions of these regulations.

Note-2: Any request for migration not covered under the provisions of these Regulations shall be referred to the Medical Council of India for consideration on individual merits by the Director (Medical Education) of the State or the Head of Central Government Institution concerned. The decision taken by the Council on such requests shall be final.

Note-3: The College/Institutions shall send intimation to the Medical Council of India about the number of students admitted by them on migration within one month of their joining. It shall be open to the Council to undertake verification of the compliance of the provisions of the regulations governing migration by the Colleges at any point of time.

Phase Wise Training and Time Distribution For Professional Development

The Competency based Undergraduate Curriculum and Attitude, Ethics and Communication (AETCOM) course, as published by the Medical Council of India and also made available on the Council's website, shall be the curriculum for the batches admitted in MBBS from the academic year 2019-20 onwards.

Provided that in respect of batches admitted prior to the academic year 2019-20, the governing provisions shall remain as contained in the Part I of these Regulations.

7. Training period and time distribution:

7.1. Every learner shall undergo a period of certified study extending over 4 ½ academic years, divided into nine semesters from the date of commencement of course to the date of completion of examination which shall be followed by one year of compulsory rotating internship.

7.2. Each academic year will have at least 240 teaching days with a minimum of eight hours of working on each day including one hour as lunch break.

7.3. Teaching and learning shall be aligned and integrated across specialties both vertically and horizontally for better learner comprehension. Learner centered learning methods should include problem oriented learning, case studies, community oriented learning, self- directed and experiential learning.

7.4. The period of 4 ½ years is divided as follows:

7.4.1 Pre-Clinical Phase [(Phase I) - First Professional phase of 13 months preceded by Foundation Course of one month]: will consist of preclinical subjects – Human Anatomy, Physiology, Biochemistry, Introduction to Community Medicine, Humanities, Professional development including Attitude, Ethics & Communication (AETCOM) module and early clinical exposure, ensuring both horizontal and vertical integration.

7.4.2 Para-clinical phase [(Phase II) - Second Professional (12 months)]: will consist of Para-clinical subjects namely

Pathology, Pharmacology, Microbiology, Community Medicine, Forensic Medicine and Toxicology, Professional development including Attitude, Ethics & Communication (AETCOM) module and introduction to clinical subjects ensuring both horizontal and vertical integration.

The clinical exposure to learners will be in the form of learner-doctor method of clinical training in all phases. The emphasis will be on primary, preventive and comprehensive health care. A part of training during clinical postings should take place at the *primary level* of health care. It is desirable to provide learning experiences in secondary health care, wherever possible**.** This will involve:

(a) Experience in recognizing and managing common problems seen in outpatient, inpatient and emergency settings,

(b) Involvement in patient care as a team member,

(c) Involvement in patient management and performance of basic procedures.

7.4.3 Clinical Phase – [(Phase III) Third Professional (28 months)]

(a) Part I (13 months) - The clinical subjects include General Medicine, General Surgery, Obstetrics & Gynaecology, Pediatrics, Orthopaedics, Dermatology, Otorhinolaryngology, Ophthalmology, Community Medicine, Forensic Medicine and Toxicology, Psychiatry, Respiratory Medicine, Radiodiagnosis & Radiotherapy and Anaesthesiology & Professional development including AETCOM module.

(b) Electives (2 months) - To provide learners with opportunity for diverse learning experiences, to do research/community projects that will stimulate enquiry, self directed experimental learning and lateral thinking [9.3].

(c) Part II (13 months) - Clinical subjects include:

i. Medicine and allied specialties (General Medicine, Psychiatry, Dermatology Venereology and Leprosy (DVL),

Respiratory Medicine including Tuberculosis)

ii. Surgery and allied specialties (General Surgery, Orthopedics [including trauma]), Dentistry, Physical Medicine and rehabilitation, Anaesthesiology and Radiodiagnosis)

iii. Obstetrics and Gynecology (including Family Welfare)

iv. Pediatrics

v. AETCOM module

7.5 Didactic lectures shall not exceed one third of the schedule; two third of the schedule shall include interactive sessions, practicals, clinical or/and group discussions. The learning process should include clinical experiences, problem oriented approach, case studies and community health care activities.

The admission shall be made strictly in accordance with the statutory notified time schedule towards the same.

7.6 Universities shall organize admission timing and admission process in such a way that teaching in the first Professional year commences with induction through the Foundation Course by the 1st of August of each year.

(i) Supplementary examinations shall not be conducted later than 90 days from the date of declaration of the results of the main examination, so that the learners who pass can join the main batch for progression and the remainder would appear for the examination in the subsequent year.

(ii) A learner shall not be entitled to graduate later than ten (10) years of her/his joining the first MBBS course.

7.7 No more than four attempts shall be allowed for a candidate to pass the first Professional examination. The total period for successful completion of first Professional course shall not exceed four (4) years. Partial attendance of examination in any subject shall be counted as an attempt.

7.8 A learner, who fails in the second Professional examination, shall not be allowed to appear in third Professional Part I examination unless she/he passes all subjects of second Professional examination.

7.9 Passing in third Professional (Part I) examination is not compulsory before

starting part II training; however, passing of third Professional (Part I) is compulsory for being eligible for third Professional (Part II) examination.

7.10 During para-clinical and clinical phases, including prescribed 2 months of electives, clinical postings of three hours duration daily as specified in Tables 5, 6, 7 and 8 would apply for various departments.

8. Phase distribution and timing of examination

8.1 Time distribution of the MBBS programme is given in Table 1.

8.2 Distribution of subjects by Professional Phase-wise is given in Table 2.

8.3 Minimum teaching hours prescribed in various disciplines are as under Tables 3-7.

8.4 Distribution of clinical postings is given in Table 8.

8.5 Duration of clinical postings will be:

8.5.1 Second Professional : 36 weeks of clinical posting (Three hours per day - five days per week : Total 540 hours)

8.5.2 Third Professional part I: 42 weeks of clinical posting (Three hours per day - six days per week : Total 756 hours)

8.5.3 Third Professional part II: 44 weeks of clinical posting (Three hours per day - six days per week : Total 792 hours)

8.6 Time allotted excludes time reserved for internal / University examinations, and vacation.

8.7 Second professional clinical postings shall commence before / after declaration of results of the first professional phase examinations, as decided by the institution/ University. Third Professional parts I and part II clinical postings shall start no later than two weeks after the completion of the previous professional examination.

8.8 25% of allotted time of third Professional shall be utilized for integrated learning with pre- and para- clinical subjects. This will be included in the assessment of clinical subjects.

Table 1: Time Distribution of MBBS Programme & Examination Schedule

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
							Foundation	I MBBS			
I MBBS								Exam I MBBS	II MBBS		
II MBBS								Exam II MBBS	III MBBS		
III MBBS Part I									Exam III MBBS Part I	Electives & Skills	
III MBBS Part II											
Exam III MBBS Part II	Internship										
Internship											

- One month is provided at the end of every professional year for completion of examination and declaration of results.

Table 2: Distribution of subjects by Professional Phase

Phase & year of MBBS training	Subjects & New Teaching Elements	Duration#	University examination
First Professional MBBS	• Foundation Course (1 month) • Human Anatomy, Physiology & Biochemistry, introduction to Community Medicine, Humanities • Early Clinical Exposure	1 + 13 months	I Professional
	• Attitude, Ethics, and Communication Module (AETCOM)		
Second Professional MBBS	• Pathology, Microbiology, Pharmacology, Forensic Medicine and Toxicology, • Introduction to clinical subjects including Community Medicine • Clinical postings • Attitude, Ethics & Communication Module (AETCOM)	12 months	II Professional
Third Professional MBBS Part I	• General Medicine, General Surgery, Obstetrics & Gynecology, Pediatrics, Orthopedics, Dermatology, Psychiatry, Otorhinolaryngology, Ophthalmology, Community Medicine, Forensic Medicine and Toxicology, Respiratory medicine, Radiodiagnosis & Radiotherapy, Anesthesiology • Clinical subjects /postings • Attitude, Ethics & Communication Module (AETCOM)	13 months	III Professional (Part I)

Electives	• Electives, Skills and assessment*	2 months	
Third Professional MBBS Part II	• General Medicine, Pediatrics, General Surgery, Orthopedics, Obstetrics and Gynecology including Family welfare and allied specialties • Clinical postings/subjects • Attitude, Ethics & Communication Module (AETCOM)	13 months	III Professional (Part II)

*Assessment of electives shall be included in Internal Assessment.

Table 3: Foundation Course (one month)

Subjects/ Contents	Teaching hours	Self Directed Learning (hours)	Total hours
Orientation [1]	30	0	30
Skills Module [2]	35	0	35
Field visit to Community Health Center	8	0	8
Introduction to Professional Development & AETCOM module	-	-	40
Sports and extracurricular activities	22	0	22
Enhancement of language/ computer skills[3]	40	0	40
	-	-	175

1. Orientation course will be completed as single block in the first week and will contain elements outlined in 9.1.
2. Skills modules will contain elements outlined in 9.1.
3. Based on perceived need of learners, one may choose language enhancement (English or local spoken or both) and computer skills. This should be provided longitudinally through the duration of the Foundation Course.

Teaching of Foundation Course will be organized by pre-clinical departments.

Table 4: First Professional teaching hours

Subjects	Lectures (hours)	Small Group Teaching/ Tutorials/ Integrated learning/ Practical (hours)	Self directed learning (hours)	Total (hours)
Human Anatomy	220	415	40	675
Physiology*	160	310	25	495
Biochemistry	80	150	20	250
Early Clinical Exposure**	90	-	0	90
Community Medicine	20	27	5	52
Attitude, Ethics & Communication Module (AETCOM) ***	-	26	8	34
Sports and extracurricular activities	-	-	-	60
Formative assessment and Term	-	-	-	80
Total	-	-	-	1736

* including Molecular Biology.

** Early clinical exposure hours to be divided equally in all three subjects.

*** AETCOM module shall be a longitudinal programme.

9. New teaching / learning elements

9.1. Foundation Course

9.1.1 **Goal:** The goal of the Foundation Course is to prepare a learner to study medicine effectively. It will be of one month duration after admission.

9.1.2 **Objectives:** The objectives are to:

(a) Orient the learner to:

(i) The medical profession and the physician's role in society

(ii) The MBBS programme

(iii) Alternate health systems in the country and history of medicine

(iv) Medical ethics, attitudes and professionalism

(v) Health care system and its delivery

(vi) National health programmes and policies (vii) Universal precautions and vaccinations (viii) Patient safety and biohazard safety

(ix) Principles of primary care (general and community based care)

(x) The academic ambience

(b) Enable the learner to acquire enhanced skills in:

(i) Language

(ii) Interpersonal relationships

(iii) Communication

(iv) Learning including self-directed learning

(v) Time management

(vi) Stress management

(vii) Use of information technology

(c) Train the learner to provide:

(i) First-aid

(ii) Basic life support

9.1.3 In addition to the above, learners may be enrolled in one of the following programmes which will be run concurrently:

(a) Local language programme

(b) English language programme

(c) Computer skills

(d) These may be done in the last two hours of the day for the duration of the Foundation Course.

9.1.4 These sessions must be as interactive as possible.

9.1.5 Sports (to be used through the Foundation Course as protected 04 hours / week).

9.1.6 Leisure and extracurricular activity (to be used through the Foundation Course as protected 02 hours per week).

9.1.7 Institutions shall develop learning modules and identify the appropriate resource persons for their delivery.

9.1.8 The time committed for the Foundation Course may not be used for any other curricular activity.

9.1.9 The Foundation Course will have compulsory 75% attendance. This will be certified by the Dean of the college.

9.1.10 The Foundation Course will be organized by the Coordinator appointed by the Dean of the college and will be under supervision of the heads of the preclinical departments.

9.1.11 Every college must arrange for a meeting with parents and their wards.

9.2. Early Clinical Exposure

9.2.1 **Objectives:** The objectives of early clinical exposure of the first-year medical learners are to enable the learner to:

(a) Recognize the relevance of basic sciences in diagnosis, patient care and treatment,

(b) Provide a context that will enhance basic science learning,
(c) Relate to experience of patients as a motivation to learn,

(d) Recognize attitude, ethics and professionalism as integral to the doctor-patient relationship,

(e) Understand the socio-cultural context of disease through the study of humanities.

9.2.2 **Elements**

(a) Basic science correlation: i.e. apply and correlate principles of basic sciences as they relate to the care of the patient (this will be part of integrated modules).

(b) Clinical skills: to include basic skills in interviewing patients, doctor-patient communication, ethics and professionalism, critical thinking and analysis and self-learning (this training will be imparted in the time allotted for early clinical exposure).

(c) Humanities: To introduce learners to a broader understanding of the socio-economic framework and cultural context within which health is delivered through the study of humanities and social sciences.

9.3. Electives

9.3.1 **Objectives**: To provide the learner with opportunities:

(a) For diverse learning experiences,

(b) To do research/community projects that will stimulate enquiry, self-directed, experiential learning and lateral thinking.

9.3.2 Two months are designated for elective rotations after completion of the examination at end of the third MBBS Part I and before commencement of third MBBS Part II.

9.3.3 It is mandatory for learners to do an elective. The elective time should not be used to make up for missed clinical postings, shortage of attendance or other purposes.

9.3.4 **Structure**

(a) The learner shall rotate through two elective blocks of 04 weeks each.

(b) Block 1 shall be done in a pre-selected preclinical or para-clinical or other basic sciences laboratory

OR under a researcher in an ongoing research project. During the electives regular clinical postings shall continue.

(c) Block 2 shall be done in a clinical department (including specialties, super-specialties, ICUs, blood bank and casualty) from a list of electives developed and available in the institution.

OR

as a supervised learning experience at a rural or urban community clinic.

(d) Institutions will pre-determine the number and nature of electives, names of the supervisors, and the number of learners in each elective based on the local conditions, available resources and faculty.

9.3.5 Each institution will develop its own mechanism for allocation of electives.

9.3.6 It is preferable that elective choices are made available to the learners in the beginning of the academic year.

9.3.7 The learner must submit a learning log book based on both blocks of the elective.

9.3.8 75% attendance in the electives and submission of log book maintained during elective is required for eligibility to appear in the final MBBS examination.

9.3.9 Institutions may use part of this time for strengthening basic skill certification.

9.4. Professional Development including Attitude, Ethics and Communication Module (AETCOM)

9.4.1 **Objectives** of the programme: At the end of the programme, the learner must demonstrate ability to:

(a) understand and apply principles of bioethics and law as they apply to medical practice and researcunderstand and apply the principles of clinical reasoning as they apply to the care of the patients,

(b) understand and apply the principles of system based care as

they relate to the care of the patient, (c) understand and apply empathy and other human values to the care of the patient,

(d) communicate effectively with patients, families, colleagues and other health care professionals,

(e) understand the strengths and limitations of alternative systems of medicine,

(f) respond to events and issues in a professional, considerate and humane fashion,

(g) translate learning from the humanities in order to further his / her professional and personal growth.

9.4.2 **Learning experiences**:

(a) This will be a longitudinal programme spread across the continuum of the MBBS programme including internship,

(b) Learning experiences may include – small group discussions, patient care scenarios, workshop, seminars, role plays, lectures etc.

(c) Attitude, Ethics &Communication Module (AETCOM module) developed by Medical Council of India should be used longitudinally for purposes of instruction.

9.4.3 75% attendance in Professional Development Programme (AETCOM Module) is required for eligibility to appear for final examination in each professional year.

9.4.4 Internal Assessment will include:

(a) Written tests comprising of short notes and creative writing experiences, (b) OSCE based clinical scenarios / viva voce.

9.4.5 At least one question in each paper of the clinical specialties in the University examination should test knowledge competencies acquired during the professional development programme.

9.4.6 Skill competencies acquired during the Professional Development Programme must be tested during the clinical, practical and viva voce.

9.5. Learner-doctor method of clinical training (Clinical Clerkship)

9.5.1 **Goal**: To provide learners with experience in:

(a) Longitudinal patient care,

(b) Being part of the health care team,

(c) Hands-on care of patients in outpatient and inpatient setting.

9.5.2 **Structure**:

(a) The first clinical posting in second professional shall orient learners to the patient, their roles and the specialty.

(b) The learner-doctor programme will progress as outlined in Table 9.

(c) The learner will function as a part of the health care team with the following responsibilities:

(i) Be part of the unit's outpatient services on admission days,

(ii) Remain with the admission unit until 6 PM except during designated class hours,

(iii) Be assigned patients admitted during each admission day for whom he/she will undertake responsibility, under the supervision of a senior resident or faculty member,

(iv) Participate in the unit rounds on its admission day and will present the assigned patients to the supervising physician,

(v) Follow the patient's progress throughout the hospital stay until discharge,

(vi) Participate, under supervision, in procedures, surgeries, deliveries etc. of assigned patients (according to responsibilities outlined in table 9),

(vii) Participate in unit rounds on at least one other day of the week excluding the admission day, (viii) Discuss ethical and other humanitarian issues during unit rounds,

(ix) Attend all scheduled classes and educational activities,

(x) Document his/her observations in a prescribed log book / case record.

(d) No learner will be given independent charge of the patient

(e) The supervising physician will be responsible for all patient care decisions

9.5.3 **Assessment**:

(a) A designated faculty member in each unit will coordinate and facilitate the activities of the learner, monitor progress, provide feedback and review the log book/ case record.

(b) The log book/ case record must include the written case record prepared by the learner including relevant investigations, treatment and its rationale, hospital course, family and patient discussions, discharge summary etc.

(c) The log book should also include records of outpatients assigned. Submission of the log book/ case record to the department is required for eligibility to appear for the final examination of the subject.

Table 9: Learner - Doctor programme (Clinical Clerkship)

Year of Curriculum	Focus of Learner - Doctor programme
Year 1	Introduction to hospital environment, early clinical exposure, understanding perspectives of illness
Year 2	History taking, physical examination, assessment of change in clinical status, communication and patient education
Year 3	All of the above and choice of investigations, basic procedures and continuity of care
Year 4	All of the above and decision making, management and outcomes

Competency Based Curriculum of The Indian Medical Graduate Programme

10. Specific Competencies

10.1. Preamble: The salient feature of the revision of the medical curriculum in 2019 is the emphasis on learning which is competency-based, integrated and learner-centered acquisition of skills and ethical & humanistic values.

Each of the competencies described below must be read in conjunction with the goals of the medical education as listed in items 2 to 3.5.5

It is recommended that didactic teaching be restricted to less than one third of the total time allotted for that discipline. Greater emphasis is to be laid on hands-on training, symposia, seminars, small group discussions, problem-oriented and problem-based discussions and self-directed learning. Learners must be encouraged to take active part in and shared responsibility for their learning.

The global competencies to be achieved by the learner are outlined above in Chapter 1- section 3. Since the MBBS programme assessment will continue to be subject based, subject specific competencies have been outlined. These have to be acquired by the learner in the corresponding professional year. These competencies must be interpreted in the larger context outlined in section 3 and may be considered as "sub competencies" of the global competencies.

10.2. Integration must be horizontal (i.e. across disciplines in a given phase of the course) and vertical (across different phases of the course). As far as possible, it is desirable that teaching/learning occurs in each phase through study of organ systems or disease blocks in order to align the learning process. Clinical cases must be used to integrate and link learning across disciplines.

10.3. Pre-clinical Subjects

10.3.1. Human Anatomy

(a) **Competencies**: The undergraduate must demonstrate:

1. Understanding of the gross and microscopic structure and development of human body,
2. Comprehension of the normal regulation and integration of the functions of the organs and systems on basis of the structure and genetic pattern,
3. Understanding of the clinical correlation of the organs and structures involved and interpret the anatomical basis of the disease presentations.

(b) **Integration**: The teaching should be aligned and integrated horizontally and vertically in organ systems with clinical correlation that will provide a context for the learner to understand the relationship between structure and function and interpret the anatomical basis of various clinical conditions and procedures.

10.3.2. Physiology

(a) **Competencies:** The undergraduates must demonstrate:

1. Understanding of the normal functioning of the organs and organ systems of the body,
2. Comprehension of the normal structure and organization of the organs and systems on basis of the functions,
3. Understanding of age-related physiological changes in the organ functions that reflect normal growth and development,
4. Understand the physiological basis of diseases.

(b **Integration**: The teaching should be aligned and integrated horizontally and vertically in organ systems in order to provide a context in which normal function can be correlated both with structure and with the biological basis, its clinical features, diagnosis and therapy.

10.3.3. Biochemistry

The course will comprise Molecular and Cellular Biochemistry.

(a) **Competencies**: The learner must demonstrate an understanding of:

1. Biochemical and molecular processes involved in health and disease,
2. Importance of nutrition in health and disease,
3. Biochemical basis and rationale of clinical laboratory tests, and demonstrate ability to interpret these in the clinical context.

(b) **Integration**: The teaching/learning programme should be integrated horizontally and vertically, as much as possible, to enable learners to make clinical correlations and to acquire an understanding of the cellular and molecular basis of health and disease.

10.3.4. Introduction to Community Medicine

(a) **Competencies**: The undergraduate must demonstrate:

1. Understanding of the concept of health and disease,
2. Understanding of demography, population dynamics and disease burden in National and global context,
3. Comprehension of principles of health economics and hospital management,
4. Understanding of interventions to promote health and prevent diseases as envisioned in National and State Health Programmes.

11. Assessment

Assessment

11.1. Eligibility to appear for Professional examinations

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

(a) Attendance

1. Attendance requirements are 75% in theory and 80% in practical /clinical for eligibility to appear for the examinations in that subject. In subjects that are taught in more than one phase – the learner must have 75% attendance in theory and 80% in practical in each phase of instruction in that subject.

2. If an examination comprises more than one subject (for e.g., General Surgery and allied branches), the candidate must have 75% attendance in each subject and 80% attendance in each clinical posting.

3. Learners who do not have at least 75% attendance in the electives will not be eligible for the Third Professional - Part II examination.

(b) **Internal Assessment**: Internal assessment shall be based on day-to-day assessment. It shall relate to different ways in which learners participate in learning process including assignments, preparation for seminar, clinical case presentation, preparation of clinical case for discussion, clinical case study/problem solving exercise, participation in project for health care in the community, proficiency in carrying out a practical or a skill in small research project

In continuation with implementation of Competency Based Medical Education (CBME) for the MBBS course from the academic year 2019-20, the following are the changes in the Internal Assessment (IA) marks and Scheme of University Examination for MBBS Phase-I:

Internal Assessment (IA) Marks:

- During the academic year, a minimum of three internal examinations will be conducted. The Preliminary Examination will be the third Internal Assessment preceding the university examination and shall be similar to the pattern of University Examination.
- Out of the three Internal Assessment marks, best of one of first and second IA examination, and preliminary examination will be considered for calculation of final IA marks. *Candidates not securing min. eligibility are required to give additional betterment Internal Assessment examination before the final university examination*. The total IA marks shall be reduced to 60 marks separately for theory and 40 Marks for practical and sent to the University as final IA Marks.

Eligibility for Final Examination:

- Candidate should secure minimum of 40% marks in Internal Assessment of Theory & Practicals separately and 50% aggregate in internal assessment examinations (Combined in Theory & Practical) in a subject to be eligible to appear for the final University Examination.

Criteria for Pass in final University Examination:

For declaration of pass in any subject in the university examination a candidate shall pass both theory and practical components separately in the same examination as stipulated below:

- For a pass in Theory Examination for each subject a student must secure **minimum 40% of marks in each of the two theory papers** with minimum 50% of marks in aggregate (both papers together).
- For a pass in Practical Examination for each subject a student must secure minimum 50% of marks in aggregate in practical and viva voce examination.
- **Internal Assessment shall be reflected as a separated head of passing in the marks card of the final University Examination.**

Supplementary Examination to be held not later than 90 days after the declaration of results.

A maximum number of *four* permissible attempts would be available to clear the pre-clinical subjects (MBBS Phase I), whereby the pre-clinical subjects will have to

be *cleared within 4 years of admission* to the course. Partial attendance at any university examination shall be counted as an availed attempt.

The student shall not be entitled to graduate after 10 years of his/her joining of the first year of the MBBS course.

1. Regular periodic examinations shall be conducted throughout the course. There shall be no less than three internal assessment examinations in each Preclinical / Para-clinical subject and no less than two examinations in each clinical subject in a professional year. An end of posting clinical assessment shall be conducted for each clinical posting in each professional year.

2. When subjects are taught in more than one phase, the internal assessment must be done in each phase and must contribute proportionately to final assessment. For example, General Medicine must be assessed in second Professional, third Professional Part I and third Professional Part II, independently.

3. Day to day records and log book (including required skill certifications) should be given importance in internal assessment. Internal assessment should be based on competencies and skills.

4. The final internal assessment in a broad clinical specialty (e.g., Surgery and allied specialties etc.) shall comprise of marks from all the constituent specialties. The proportion of the marks for each constituent specialty shall be determined by the time of instruction allotted to each.

5. Learners must secure at least 50% marks of the total marks (combined in theory and practical / clinical; not less than 40 % marks in theory and practical separately) assigned for internal assessment in a particular subject in order to be eligible for appearing at the final University examination of that subject. Internal assessment marks will reflect as separate head of passing at the summative examination.

6. The results of internal assessment should be displayed on the notice board within a 1-2 weeks of the test. Universities shall guide the colleges regarding formulating policies for remedial measures for students who are either not able to score qualifying marks or have missed on some assessments due to any reason.

7. Learners must have completed the required certifiable competencies for that phase of training and completed the log book appropriate for that phase of training to be eligible for appearing at the final university examination of that subject.

University Examination

11.2.1 University examinations are to be designed with a view to ascertain whether the candidate has acquired the necessary knowledge, minimal level of skills, ethical and professional values with clear concepts of the fundamentals which are necessary for him/her to function effectively and appropriately as a physician of first contact. Assessment shall be carried out on an objective basis to the extent possible.

11.2.2 Nature of questions will include different types such as structured essays (Long Answer Questions - LAQ), Short Answers Questions (SAQ) and objective type questions (e.g. Multiple Choice Questions - MCQ). Marks for each part should be indicated separately. MCQs shall be accorded a weightage of not more than 20% of the total theory marks. In subjects that have two papers, the learner must secure at least 40% marks in each of the papers with minimum 50% of marks in aggregate (both papers together) to pass.

11.2.3 Practical/clinical examinations will be conducted in the laboratories and /or hospital wards. The objective will be to assess proficiency and skills to conduct experiments, interpret data and form logical conclusion. Clinical cases kept in the examination must be common conditions that the learner may encounter as a physician of first contact in the community. Selection of rare syndromes and disorders as examination cases is to be discouraged. Emphasis should be on candidate's capability to elicit history, demonstrate physical signs, write a case record, analyze the case and develop a management plan.

11.2.4 Viva/oral examination should assess approach to patient management, emergencies, attitudinal, ethical and professional values. Candidate's skill in interpretation of common

investigative data, X-rays, identification of specimens, ECG, etc. is to be also assessed.

11.2.5 There shall be one main examination in an academic year and a supplementary to be held not later than 90 days after the declaration of the results of the main examination.

11.2.6 A learner shall not be entitled to graduate after 10 years of his/ her joining of the first part of the MBBS course.

11.2.7 University Examinations shall be held as under:

(a) First Professional

1. The first Professional examination shall be held at the end of first Professional training (1 + 12 months), in the subjects of Human Anatomy, Physiology and Biochemistry.

2. A maximum number of four permissible attempts would be available to clear the first Professional University examination, whereby the first Professional course will have to be cleared within 4 years of admission to the said course. Partial attendance at any University examination shall be counted as an availed attempt.

3. The discipline of Psychiatry and Dermatology, Venereology and Leprosy (DVL), Respiratory Medicine including Tuberculosis will constitute 25% of the total theory marks in General Medicine incorporated as a separate section in paper II of General Medicine.

(d) Examination schedule is in Table 1.

(e) Marks distribution is in

Table 10. Table 10 : Marks distribution for

Phase of Course	Written-Theory – Total	Practicals/ Orals/ Clinicals	Pass Criteria
First Professional			Internal Assessment: 50% combined in theory and practical (not less than 40% in each) for eligibility for appearing for University Examinations University Examination Mandatory 50% marks separately in theory and practical (practical = practical/ clinical + viva)
Human Anatomy - 2 papers	200	100	
Physiology - 2 papers	200	100	
Biochemistry - 2 papers	200	100	
Second Professional			
Pharmacology - 2 Papers	200	100	
Pathology - 2 papers	200	100	
Microbiology - 2 papers	200	100	
Third Professional Part – I			
Forensic Medicine & Toxicology - 1 paper	100	100	
Ophthalmology – 1 paper	100	100	
Otorhinolaryngology – 1 paper	100	100	
Community Medicine - 2 papers	200	100	
Third Professional Part – II			
General Medicine - 2 papers	200	200	
General Surgery - 2 papers	200	200	
Pediatrics – 1 paper	100	100	
Obstetrics & Gynaecology - 2 papers	200	200	

Note: At least one question in each paper of the clinical specialties should test knowledge - competencies acquired during

the professional development programme (AETCOM module); Skills competencies acquired during the Professional

Development programme (AETCOM module) must be tested during clinical, practical and viva.

In subjects that have two papers, the learner must secure at least 40% marks in each of the papers with minimum 50% of marks in aggregate (both papers together) to pass in the said subject.

11.2.8 **Criteria for passing in a subject**: A candidate shall obtain 50% marks in University conducted examination separately in Theory and Practical (practical includes: practical/ clinical and viva voce) in order to be declared as passed in that subject.

11.2.9 **Appointment of Examiners**

(a) Person appointed as an examiner in the particular subject must have at least four years of total teaching experience as assistant professor after obtaining postgraduate degree in the subject in a college affiliated to a recognized/approved/ permitted medical college.

(b) For the Practical/ Clinical examinations, there shall be at least four examiners for 100 learners, out of whom not less than 50% must be external examiners. Of the four examiners, the senior-most internal examiner will act as the Chairman and coordinator of the whole examination programme so that uniformity in the matter of assessment of candidates is maintained. Where candidates appearing are more than 100, two additional examiners (one external & one internal) for every additional 50 or part there of candidates appearing, be appointed.

(c) In case of non-availability of medical teachers, approved teachers without a medical degree (engaged in the teaching of MBBS students as whole-time teachers in a recognized medical college), may be appointed examiners in their concerned subjects provided they possess requisite doctorate qualifications and four years teaching experience (as assistant professors) of MBBS students. Provided further that the 50% of the examiners (Internal & External) are from the medical qualification stream.

(d) External examiners may not be from the same University.

(e) The internal examiner in a subject shall not accept external examinership for a college from which external examiner is appointed in his/her subject.

(f) A University having more than one college shall have separate sets of examiners for each college, with internal examiners from the concerned college.

(g) External examiners shall rotate at an interval of 2 years.

(h) There shall be a Chairman of the Board of paper-setters who shall be an internal examiner and shall moderate the questions.

(i) All eligible examiners with requisite qualifications and experience can be appointed internal examiners by rotation in their subjects.

(j) All theory paper assessment should be done as central assessment program (CAP) of concerned university.

(k) Internal examiners should be appointed from same institution for unitary examination in same institution. For pooled examinations at one centre approved internal examiners from same university may be appointed.

(l) The grace marks up to a maximum of five marks may be awarded at the discretion of the University to a learner for clearing the examination as a whole but not for clearing a subject resulting in exemption.

Foundation Course

The purpose of the Foundation Course include:

a) Orienting the students to all aspects of the medical college environment.

b) Equipping them with certain basic, but important, skills required for patient care and enhancing their communication, language, computer and learning skills.

c) Providing opportunity for peer and faculty interactions and an overall sensitisation to the various learning methodologies.

This is proposed to be achieved through a dedicated one month exclusive "Foundation Course", at the beginning of the MBBS course, to orient and sensitize the student to the various identified areas.

The objectives are to:

(i) Orient the learner to:

a. The medical profession and the physician's role in society

b. The MBBS programme

c. Alternate health systems in the country and history of medicine

d. Medical ethics, attitudes and professionalism

e. Health care system and its delivery

f. National health priorities and policies

g. Universal precautions and vaccinations

h. Patient safety and biohazard safety

i. Principles of primary care (general and community-based care)

j. The academic ambience

(ii) Enable the learner to acquire enhanced skills in:

a. Language

b. Interpersonal relationships

c. Communication

d. Learning including self-directed learning

e. Time management

f. Stress management

g. Use of information technology

(iii) Train the learner to provide:

a. First-aid

b. Basic life support

In addition to the above, learners may be enrolled in one of the following programmes which will be run concurrently:

(i) Local language programme

(ii) English language programme

(iii) Computer skills

Structure of the program for students

Subjects/ Contents	**Total Teaching hours**
Orientation	30
Skills Module	35
Field visit to Community Health Centre	8
Professional Development including ethics	40
Sports and Extracurricular activities	22
Enhancement of language/ computer skills	40
Total teaching hours	175

Note:

- Foundation Course is compulsory and an attendance of 75% will be mandatory
- Feedback, comments and/or grades about the student's performance by the faculty mentor will be documented particularly for the skills training in the log book
- The performance of the students in the Foundation Course will **NOT** contribute towards internal assessment marks.

Medical Council of India

AETCOM

ATTITUDE, ETHICS & COMMUNICATION

Communication

Reliability

Patient centered

Professionalism

Personal growth

Leadership

Respect

Teamwork

Accountability

Responsiveness

Lifelong learning

Attitude

System based learning

Responsibility

Social Commitment

Values

Knowledge	Skills	Attitudes	Values	Responsiveness	Communication

2018

Learning modules for Professional year I

Number of modules: 5

Number of hours: 34

Module 1.1: What does it mean to be a doctor?

Background

It is important for new entrants to get a holistic view of their profession, its ups and downs, its responsibilities and its privileges. It is important to start this discussion early in their careers when their minds are still fresh with the thrill of joining medical school. Such a discussion will help them remember the big picture through the program and remind them why they have chosen to be doctors.

Competencies addressed

The student should be able to:	**Level**
1. Enumerate and describe professional qualities and roles of a physician	KH
2. Describe and discuss the commitment to lifelong learning as an important part of physician growth	KH
3. Describe and discuss the role of a physician in health care system	KH
4. Identify and discuss physician's role and responsibility to society and the community that she/ he serves	KH

Learning Experience

Year of study: Professional year 1

Hours: 8 (6 hours + 2 hours self-directed learning)

i. Exploratory session- 1 hour

ii. Facilitated panel discussion – 2 hours

iii. Self-directed learning - 2 hours

iv. Introductory visit to the hospital – 2 hours

v. Discussion and closure of case - 1 hour

1. An exploratory session with the students to find out (a) why they chose to become doctors, (b) what do they think are the privileges and the responsibilities of the profession, (c) what do they expect from society and what do they think society expects from them, and (d) what will they have to do and give up in order to meet their own and society's expectations. This is preferably done in a small group discussion.

2. A facilitated panel discussion involving doctors who are at different stages of their careers (senior, midlevel, young) during which these doctors share their experiences and also answer questions from the students.

3. Self-directed learning where students write a report from reflections based on sessions 1 & 2 and on other reading materials, TV series, movies etc. that they have chosen from the lay press about doctors' experiences.

4. Introductory visit to the hospital / community medical centres

5. A closure session with students to share their reflections based on 1, 2, 3 and 4 that includes their plans for the next 5 years in order to fulfill their professional and personal roles as doctors.

6. A coat ceremony in the Foundation Course may be considered. A white coat ceremony is held in many institutions, as a symbolic transition of the medical student prior to their first day of exposure to clinical teaching, in order to emphasize the importance of their new role as budding doctors.

Assessment

1. **Formative:** not required
2. **Summative:** not required

Resources

1. Whitcomb ME. What does it mean to be a physician? Acad Med.2007; 82: 917-8.

2. Eisenberg C. It is still a privilege to be a doctor? N Engl J Med 1986; 314:1113-1114.

3. Ofri D. Neuron overload and the juggling doctor. The Lancet 2010; 376: 1820 – 21.

Module 1.2: What does it mean to be a patient?

Background

Doctors deal with human suffering throughout their professional careers. A balanced approach to the patient care experience requires an understanding of patients, illnesses, their concepts of suffering, coping mechanisms, the role of the doctor, an exploration of empathy vs equanimity and the difference between healing and curing. An introduction to this fundamental but complex field is important in the first Professional year. An introductory experience will allow students to keep the patient experience in perspective during their learning.

Competencies addressed

The student should be able to:	**Level**
1. Enumerate and describe professional qualities and roles of a physician	KH
2. Demonstrate empathy in patient encounters	SH

Learning Experience

Year of study: Professional year 1

Hours: 8 (6 hours + 2 hours self-directed learning)

i. Exploratory session - 2 hours

ii. Hospital visit - 2 hours

iii. Self-directed learning - 2 hours

iv. Discussion and closure of case - 2 hours

1. An exploratory session with the students enquiring from them about their views on health, disease and suffering. Discussion could involve their personal ill health or involving someone they know among their families and friends. How did that experience affect them? What do they believe patients feel and go through? How does it affect patient's behaviour, outlook and expectations?

2. Students are assigned to patients in the hospital, interview them about their experiences, reactions, emotions, outlook and expectations.

3. Self-directed learning where students write a report from reflections based on sessions 1 & 2 and on other readings, TV series movies etc.

4. A closure session with students to share their reflections based on 1, 2 and 3.

Assessment

1. **Formative:** The student may be assessed based on their active participation and presentation (written and oral).

2. **Summative:** SAQ

Module 1.3: The Doctor-Patient Relationship

Background

The doctor-patient relationship is the cornerstone to effective patient care. This session builds on the previous two sessions which address doctors and patients and attempts to explore the fundamental basis of the doctor-patient contract, its rules, boundaries and duties. It provides an introduction to the nature of relationship, importance of communication, honesty, transparency, shared responsibility, equality and vulnerability.

This introductory session, though complex, will provide an overview for the student to provide them with a perspective on the doctor-patient relationship throughout their years of study.

Competencies addressed

The student should be able to: Level	
1.Enumerate and describe professional qualities and roles of a physician KH	
2. Demonstrate empathy in patient encounters SH	

Learning Experience

Year of study: Professional year 1

Hours: 7 hours (5 hours + 2 hours of self-directed learning)

i. Large group session- 1 hour

ii. Self-directed learning - 2 hours

iii. Interactive discussions – 2 hours

iv. Discussion and closure – 2 hours

1. Anchoring a large group session emphasising the fundamentals of the doctor-patient relationship (1 hour).

2. Self-directed/Guided learning by students on the doctor-patient relationship that includes learning from resources, lay press, media and movies (2 hours).

3. An interactive discussion in a small group, based on session 1, with illustrative

cases. Examples of cases that can be used are provided in the resources section (2 hours) (or) a patient-doctor encounter observation with checklist may be used.

4. A closure session with reflection by the students, based on items 1, 2 and 3.

Assessment

1. **Formative:** The student may be assessed based on their active participation in the sessions. A written critique of the situations discussed in item 2 may be used for formative assessment.

2. **Summative:** Short questions for example a) rights of patients, b) responsibilities of patients, c) duties of doctors, and d) boundaries of the doctor-patient relationship.

Resources

1. http://www.cpso.on.ca/policies-publications/the-practice-guide-medicalprofessionalism- and-col/principles-of-practice-and-duties-of-physicians

Case for discussion 1:

A 53 year old man is seen by a cardiologist for chest pain lasting for a few minutes on accustomed exercise for the past 3 weeks. After a detailed history and physical examination, the doctor orders an ECG which was normal. He further orders an exercise stress test which showed reversible ischemia. The doctor orders an angiogram. At the time, the patient requests that he would like to have a second opinion. The cardiologist explains that he has done everything correctly and that the patient indeed requires an angiogram. The patient tells him that he cannot make a decision unless he talks to his family doctor of 20 years. The cardiologist is offended and tells the patient that he does not wish to see the patient any longer.

Points for discussion:

1. Trust in the doctor-patient relationship.

2. Rights of a patient, Duties of a doctor.

3. Does the request for a second opinion provide sufficient grounds to terminate the doctor-patient relationship?

Case for discussion 2:

A young doctor has been taking care of an 86 year old woman for the past 2

years. She had a fall 2 years ago and has been mostly bed ridden. She lives alone with just a care taker and her children are abroad. She requires preventive care mostly and the doctor makes house visits once a week. The doctor spends time talking to her during each visit and makes her feel comfortable. One day during such a visit, the patient expresses the view that her children have been ungrateful to her and that she intends to call her lawyer today and divide her assets between the doctor and the caretaker after her death.

What should the doctor do?

Points for discussion:

1. Boundaries in the doctor-patient relationship.
2. Trust and vulnerability in doctor-patient relationship.

Resources:

1. AMA Code of Medical Ethics: https://www.ama-assn.org/delivering - care/ amacode- medical-ethics (for case 1)
2. https://www.dovepress.com/getfile.php fileID = 1351 (for case 2)

Module 1.4: The foundations of communication - 1

Background

Communication is a fundamental prerequisite in the medical profession and bedside clinical skills is crucial in ensuring professional success for doctors. This module provides students with an introduction to doctor-patient communication. The Kalamazoo consensus statement1 provides a working model of teaching communication skills and may be used to impart communication skills. The five 'A's elements of behaviour change model may also be used. Effective listening, verbal and nonverbal communication and creating respect in patient encounters would be the skills that would be introduced.

Competency addressed

The student should be able to: Level	
Demonstrate ability to communicate to patients in a patient, respectful, nonthreatening, non- judgmental and empathetic manner	SH

Learning Experience

Year of study: Professional Year 1

Hours: 7 hours (5 hours + 2 hours self-directed learning)

i. Large group session- 2 hours

ii. Self-directed learning - 2 hours

iii. Small group discussions – 2 hours

iv. Discussion and closure – 1 hour

Contents:

This module includes 3 interdependent learning sessions:

1. Introductory large group sessions on the principles of communication.
2. Self-directed/Guided learning by students on the importance and techniques of effective communication.
3. Small group sessions on improving communication. These sessions can include

either videos or role play highlighting common mistakes in patient - doctor communication and allowing students to identify these mistakes and discussing on how to correct them. Situations that can be used include: a) a noisy ambience with a distracted doctor who is multitasking, b) lack of eye contact, c) doctor who keeps on interrupting patients and not listening, d) doctor who talks down to patients etc.

4. Closure session with reflection by students in a small group based on sessions 1, 2 and 3 and with emphasis on learning done and future directions.

Assessment

1. **Formative:** The student may be assessed based on their active participation in the sessions. A written critique of the situations discussed in item 3 may be used for formative assessment.

2. **Summative:** may be deferred for later phases.

Resource:

1. Makoul G. Essential elements of communication in medical encounters: the Kalamazoo consensus statement. Acad Med. 2001; Apr; 76(4): 390-3.

Module 1.5: The cadaver as our first teacher

Background

Medical students enter college and their first and lasting encounter is with the cadaver. Respect for cadaver as a teacher translates later into respect for human beings as teachers and a lifelong respect for learning. Throughout the world the emphasis on "humanizing" the cadaver with respect as first patient or first teacher has gained momentum.

Competency addressed

The student should be able to: Level	
Demonstrate respect and follows the correct procedure when handling cadavers and other biologic tissues	SH

Learning Experience

Year of study: Beginning and end of Professional year 1

Hours: 4 (2 + 2) hours

i. Opening session- 2 hours

ii. Closing session - 2 hours

Contents:

1. An initial introductory session (large or small group) should be on the importance of biologic tissues and cadavers in their learning. The discussion should focus on the fact that some of these cadavers were unclaimed but also many of them are an anatomic gift by families; respect for donor families, cadavers and tissues is important and must be respected. The session should include safe and clean handling and disposal of biologic tissues (2 hours).

2. A session at the end of phase is a small group or large group discussion with reflective presentations by students on how the cadaver helped them to learn, their experience with dissection etc. These sessions should allow the students to display their creativity and may include prose, poetry, sketches etc. An example of such a project is found in the resources section (2 hours).

Assessment

1. **Formative:** The student may be assessed based on their active participation in the sessions. The respect and the manner in which students handle biologic tissues throughout the phase may be part of the overall formative assessment of the student.
2. **Summative:** may not be required.

Resource: http://medicine.yale.edu/education/donation/reflections/ (An example of the project is found here).

The question pertaining to module of AETCOM will be asked in the form of one short answer question (3marks) in any one of the six theory papers of pre-clinical subjects in the final university examination.

ANATOMY

ANATOMY

This draft syllabus has been created from the list of **competencies** mentioned in the **Competency Based Curriculum (CBC)** developed by the **Medical Council of India** for the First MBBS Batch of 2019-20. The subject has been divided into the following broad areas:

A. General anatomy

B. General & Systemic histology

C. Genetics

D. General & Systemic embryology

E. Upper limb

F. Thorax

G. Abdomen

H. Pelvis

I. Lower limb

J. Head and neck

K. Neuroanatomy

L. Ethics in anatomy

In each of these broad areas, topics have been specified. The content to be covered under each topic has been mentioned as bulleted points. For each topic, competency numbers have been mentioned as per the competency list mentioned above. The content that is related to non core competencies **(these competencies need not be assessed in the summative examination) have been marked by an asterisk (*).**

Goals and Departmental objectives for the undergraduate (MBBS) Curriculum in Anatomy

Goal

The broad goal of teaching 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.

A. Knowledge

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

1) Comprehend the normal disposition, clinically relevant interrelationship, functional and cross sectional anatomy of the various structures in the body.

2) 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.

3) Comprehend the basic structure and connections of the central nervous system to analyse the integrative and regulative functions of the organs and systems. He/She shall be able to locate the site of gross lesions according to the deficits encountered.

4) 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 teratogens, genetic mutations and environmental hazards. He/She shall be able to explain the developmental basis of the major variations and abnormalities.

B. Skills

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

1) Identify and locate all the structures of the body and mark the topography of the living anatomy.

2) Identify the organs and tissues under the microscope.

3) Understand the principles of karyotyping and identify the gross congenital anomalies.

4) Understand principles of newer imaging techniques and interpretation of Computerised Tomography (CT) Scan, Sonogram, etc.

5) Understand clinical basis of some common clinical procedures i.e. intramuscular and intravenous injection, lumbar puncture, etc.

C. Attitude and communication skills

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

1. Show due respect in handling human body parts and cadavers during dissection.
2. Communicate effectively with peers and teachers in small group teaching-learning activities.
3. Demonstrate the ability to work effectively with peers in a team.
4. Demonstrate professional attributes of punctuality, accountability and respect for teachers and peers.
5. Appreciate the issues of equity and social accountability while undergoing early clinical exposure.

COURSE CONTENTS:

Syllabus of Anatomy at a Glance

1. General Anatomy: Basic tissues of the body, Terminology and Nomenclature, History of Anatomy
2. Elements of Anatomy: Osteology, Arthrology, Myology, Angiology, Neurology.
3. Regional Anatomy: Upper limb, Lower limb, Thorax-including diaphragm, Abdomen including Pelvis, Head and Neck, Brain and Spinal cord.
4. Embryology: Development of individual organs and systems. Postnatal Growth & Development.
5. Histology: General Histology, Microanatomy of individual organs and systems.
6. Human Genetics: Principles of Human Genetics and Molecular Biology.
7. Radiological Anatomy: Skiagrams , Special X-Rays, CT scan and MRI.
8. Living Anatomy

9. Sectional Anatomy: Head & Neck, Brain, Thorax, Abdomen including Pelvis.
10. Applied Anatomy: As applicable.

Syllabus

A. GENERAL ANATOMY

Topic: Anatomical terminology (AN1.1)

- Normal anatomical position
- Planes of the body
- Terms used for relations and comparison
- Terms used for movements of the body

Topic: General features of bones and Joints (AN1.2, AN2.1 to AN2.6)

- Composition of bone and bone marrow
- Parts, blood and nerve supply of a long bone
- Laws of ossification*
- Special features of a sesamoid bone*
- Types of cartilage with its structure and distribution in body
- Joints with subtypes and examples
- Nerve supply of joints and Hilton's law

Topic: General features of Muscle (AN3.1 to AN3.3)

- Classification of muscle tissue according to structure and action
- Parts of skeletal muscle
- Differences between tendons and aponeuroses with examples
- Shunt and spurt muscles*

Topic: General features of skin and fascia (AN4.1 to AN4.5)

- Types of skin and dermatomes in body*
- Structure and function of skin
- Superficial fascia along with fat distribution in body
- Modifications of deep fascia with its functions
- Principles of skin incisions*

Topic: General features of the cardiovascular system (AN5.1 to AN5.8)

- Differences between blood vascular and lymphatic system
- Differences between pulmonary and systemic circulation
- General differences between arteries and veins
- Functional differences between elastic, muscular arteries and arterioles
- Concept of portal system with examples
- Concept of anastomoses and collateral circulation with significance of end arteries
- Functions of meta arterioles, precapillary sphincters, arterio-venous anastomoses*
- Definition of thrombosis, infarction and aneurysm*

Topic: General Features of lymphatic system (AN6.1 to AN6.3)

- Components and functions of the lymphatic system*
- Structure of lymph capillaries and mechanism of lymph circulation*
- Concept of lymphedema and spread of tumors via lymphatics and venous system .

Topic: Introduction to the nervous system (AN7.1 to AN7.8)

- General plan of nervous system with components of central, peripheral and autonomic nervous systems
- Components of nervous tissue and their functions
- Parts of a neuron
- Classification of neurons based on structure and function
- Structure of a typical spinal nerve
- Principles of sensory and motor innervation of muscles*
- Concept of loss of innervation of a muscle with its applied anatomy
- Type of synapses*
- Differences between sympathetic and spinal Ganglion*

B. GENERAL HISTOLOGY

Topic: Epithelium (AN65.1 to AN65.2)

- Identification of epithelium under the microscope
- Correlation of structure and function of epithelia
- Ultrastructure of epithelium*

Topic: Connective tissue histology (AN66.1 to AN66.2)

- Types of connective tissue with functional correlation
- Ultrastructure of connective tissue*

Topic: Muscle histology (AN67.1 to AN67.3)

- Classification of muscle
- Structure-function correlation of muscle
- Ultrastructure of muscle tissue*

Topic: Nervous tissue histology (AN68.1 to AN68.3)

- Description and identification of unipolar and multipolar neurons, ganglia, peripheral nerve
- Structure-function correlation of neuron
- Ultrastructure of nervous tissue*

Topic: Blood vessels – histology (AN69.1 to AN69.3)

- Identification of elastic and muscular blood vessels, capillaries under the microscope
- Types and structure-function correlation of blood vessels
- Ultrastructure of blood vessels*

Topic: Glands and Lymphoid tissue (AN70.1 to AN70.2)

- Identification of exocrine glands under the microscope
- Differentiation between serous, mucous and mixed acini
- Identification of lymphoid tissue under the microscope
- Microanatomy of lymph node, spleen, thymus, tonsil and correlation of structure with function

Topic: Bone and Cartilage (AN71.1 to AN71.2)

- Identification of bone under the microscope
- Types and structure-function correlation of bone
- Identification of cartilage under the microscope
- Types and structure function correlation of cartilage

Topic: Integumentary System (AN72.1)

- Identification of skin and its appendages under the microscope
- Correlation of structure and function

C. GENETICS

Topic: Chromosomes (AN73.1 to AN73.3)

- Structure of chromosomes with classification
- Technique of karyotyping with its applications
- Lyon¹s hypothesis

Topic: Patterns of Inheritance (AN74.1 to AN74.4)

- Various modes of inheritance with examples
- Pedigree charts for the various types of inheritance
- Examples of diseases of each mode of inheritance
- Multifactorial inheritance with examples
- Genetic basis and clinical features of achondroplasia, cystic fibrosis, vitamin D resistant rickets, haemophilia, Duchenne's muscular dystrophy and sickle cell anaemia*

Topic: Principle of Genetics, Chromosomal Aberrations and Clinical Genetics (AN75.1 to AN75.5)

- Structural and numerical chromosomal aberrations
- Mosaics and chimeras with examples
- Genetic basis and clinical features of Prader Willi syndrome, Edward syndrome and Patau syndrome*
- Genetic basis of variation: polymorphism and mutation
- Principles of genetic counselling

D. GENERAL EMBRYOLOGY

Topic: Introduction to embryology (AN76.1 TO AN76.2)

- Stages of human life
- Terms - phylogeny, ontogeny, trimester, viability

Topic: Gametogenesis and fertilization (AN77.1 to AN77.6)

- Uterine changes occurring during the menstrual cycle
- Synchrony between the ovarian and menstrual cycles
- Spermatogenesis and oogenesis
- Stages and consequences of fertilization
- Anatomical principles underlying contraception
- Teratogenic influences; fertility and sterility, surrogate motherhood, social significance of "sex ratio"*

Topic: Second week of development (AN78.1 to AN78.5)

- Cleavage and formation of blastocyst
- Development of trophoblast
- Process of implantation and common abnormal sites of implantation
- Formation of extra embryonic mesoderm and coelom, bilaminar disc and prochordal plate
- Abortion, decidual reaction, pregnancy tests

Topic: 3rd to 8th week of development (AN79.1 to AN79.6)

- Formation and fate of the primitive streak
- Formation and fate of notochord
- Process of neurulation
- Development of somites and intra embryonic coelom
- Embryological basis of congenital malformations, nucleus pulposus, sacrococcygeal teratomas, neural tube defects
- Diagnosis of pregnancy in first trimester*
- Role of teratogens, alpha fetoprotein*

Topic: Fetal membranes (AN80.1 to AN80.7)

- Formation, functions and fate of chorion, amnion, yolk sac, allantois and decidua
- Formation and structure of umbilical cord
- Formation of placenta, its physiological functions, foeto maternal circulation and placental barrier
- Embryological basis of twinning in monozygotic and dizygotic twins
- Role of placental hormones in uterine growth and parturition
- Embryological basis of estimation of fetal age*
- Types of umbilical cord attachments*

Topic: Prenatal Diagnosis (AN81.1 to AN81.3)

- Methods of prenatal diagnosis
- Indications, process and disadvantages of amniocentesis
- Indications, process and disadvantages of chorion villus biopsy

E. UPPER LIMB

Topic: Features of individual bones (Upper Limb) (AN8.1 to AN8.6)

- Clavicle, scapula, humerus, radius, ulna side determination, anatomical position and important features
- Joints formed by the given bone
- Peculiarities of clavicle
- Muscle group attachments on above bones
- Identification and naming of bones in articulated hand
- Parts of metacarpals and phalanges
- Peculiarities of pisiform
- Scaphoid fracture and basis of avascular necrosis*

Topic: Pectoral region (AN9.1 to AN 9.3)

- Pectoralis major, pectoralis minor attachment, nerve supply and action
- Breast - location, extent, deep relations, structure, age changes, blood supply, lymphatic drainage, microanatomy and applied anatomy
- Development of breast*

Topic: Axilla, Shoulder and Scapular region (AN 10.1 to AN10.13)

- Axilla - boundaries and contents
- Axillary artery and tributaries of vein - origin, extent, course, parts, relations and branches
- Brachial plexus - formation, branches, relations, area of supply of branches, course and relations of terminal branches
- Axillary lymph nodes - anatomical groups and areas of drainage
- Variations in formation of brachial plexus
- Erb's palsy and Klumpke's paralysis - anatomical basis and clinical features*
- Enlarged axillary lymph nodes – anatomical basis*
- Latissmus dorsi and trapezius - location, attachment, nerve supply and actions
- Arterial anastomosis around the scapula*
- Boundaries of triangle of auscultation*
- Deltoid and rotator cuff muscles
- Serratus anterior - attachment and actions
- Shoulder joint - type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements, muscles involved, blood supply, nerve supply and applied anatomy
- Anatomical basis of injury to axillary nerve during intramuscular injections*

Topic: Arm and Cubital fossa (AN11.1 to AN11.6)

- Muscle groups of upper arm
- Biceps and triceps brachii
- Important nerves and vessels in arm - origin, course, relations, branches (or tributaries), termination
- Venepuncture of cubital veins - anatomical basis
- Saturday night paralysis - anatomical basis
- Cubital fossa - boundaries and contents
- Anastomosis around elbow joint*

Topic: Forearm and hand (AN12.1 to AN12.15)

- Ventral forearm muscle groups with attachments, nerve supply and actions
- Nerves and vessels of forearm - origin, course, relations, branches (or tributaries), termination
- Flexor retinaculum - identification and attachments
- Anatomical basis of carpal tunnel syndrome
- Small muscles of hand
- Movements of thumb and muscles involved
- Blood vessels and nerves in hand - course and branches
- Anatomical basis of claw hand
- Fibrous flexor sheaths, ulnar bursa, radial bursa and digital synovial sheaths
- Infection of fascial spaces of palm*
- Dorsal forearm muscle groups - attachments, nerve supply and actions
- Origin, course, relations, branches (or tributaries), termination of

important nerves and vessels of back of forearm

- Wrist drop - anatomical basis
- Compartments deep to extensor retinaculum
- Extensor expansion – identification and formation

Topic: General Features, Joints, Radiographs and Living Anatomy (AN13.1 to AN13.8)

- Fascia of upper limb and compartments
- Veins of upper limb
- Lymphatic drainage of upper limb
- Dermatomes of upper limb*
- Elbow joint, proximal and distal radio ulnar joints, wrist joint and first carpometacarpal joint - type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements, blood and nerve supply
- Sternoclavicular joint, acromioclavicular joint, carpometacarpaljoints and metacarpophalangeal joints*
- Bones and joints of upper limb seen in anteroposterior and lateral view radiographs of shoulder region, arm, elbow, forearm and hand
- Bony landmarks of upper limb - jugular notch, sternal angle, acromial angle, spine of the scapula, vertebral level of the medial end, inferior angle of the scapula
- Palpation of brachial artery and radial artery
- Testing of muscles: trapezius, pectoralis major, serratus anterior, latissimus dorsi, deltoid, biceps brachii, brachioradialis
- Development of upper limb*

F. THORAX

Topic: Thoracic cage (AN21.1 to AN21.11)

- Salient features of sternum, typical rib, 1st rib and typical thoracic vertebra
- Features of 2nd, 11th and 12th ribs*
- Features of 1st, 11th and 12th thoracic vertebrae*
- Boundaries of thoracic inlet, cavity and outlet
- Extent, attachments, direction of fibres, nerve supply and actions of intercostal muscles
- Course, relations and branches of a typical intercostal nerve
- Origin, course and branches / tributaries of anterior, posterior intercostal vessels and internal thoracic vessels
- Origin, course, relations and branches of atypical intercostal nerve, superior intercostal artery and subcostal artery*
- Type, articular surfaces and movements of manubriosternal, costovertebral, costotransverse and xiphisternal joints
- Mechanics and types of respiration
- Costochondral and interchondral joints*
- Boundaries and contents of the superior, anterior, middle and posterior mediastinum

Topic: Heart and Pericardium (AN22.1 to AN22.7)

- Pericardium - subdivisions, sinuses, blood supply and nerve supply
- External and internal features of each chamber of the heart
- Origin, course and branches of coronary arteries
- Anatomical basis of ischaemic heart disease
- Formation, course, tributaries and termination of coronary sinus

- Fibrous skeleton of heart
- Position and arterial supply of the conducting system of heart

Topic: Mediastinum (AN23.1 to AN23.7)

- Oesophagus - external appearance, relations, blood supply, nerve supply, lymphatic drainage and applied anatomy
- Thoracic duct - extent, relations, tributaries and applied anatomy
- Origin, course, relations, tributaries and termination of superior venacava, azygos, hemiazygos and accessory hemiazygos veins
- Branches and relations of arch of aorta and descending thoracic aorta
- Location and extent of thoracic sympathetic chain
- Description of splanchnic nerves*
- Right lymphatic duct – extent, relations and applied anatomy

Topic: Lungs and Trachea (AN24.1 to AN24.6)

- Pleura – extent, recesses with their applied anatomy, blood supply, lymphatic drainage and nerve supply
- Lungs – side determination, external features including root and clinical correlates
- Description of bronchopulmonary segments
- Phrenic nerve - formation and distribution
- Blood supply, lymphatic drainage and nerve supply of lungs
- Extent, length, relations, blood supply, lymphatic drainage and nerve supply of trachea*

Topic: Radiological anatomy of thorax (AN25.7 and AN25.8)

- Identification of structures seen on a plain x ray chest (PA view)
- Identification of and description in brief of a barium swallow*

Topic: Histology of thorax (AN25.1)

- Identification, drawing and labelling of a slide of trachea and lung

Topic: Embryology of thorax (AN25.2 to AN25.6)

- Development of pleura, lung and heart
- Fetal circulation and changes occurring at birth
- Embryological basis of: 1) atrial septal defect, 2) ventricular septal defect, 3) Fallot's tetralogy and 4) tracheo oesophageal fistula
- Developmental basis of common cardiac congenital anomalies, transposition of great vessels, dextrocardia, patent ductus arteriosus and coarctation of aorta
- Development of aortic arch arteries, superior vena cava, inferior vena cava and coronary sinus*

G. ABDOMEN AND PELVIS

Topic: Anterior abdominal wall (AN44.1 to AN44.7)

- Planes (transpyloric, transtubercular, subcostal, lateral vertical), regions and quadrants of abdomen
- Anterior abdominal wall – fascia, blood vessels and nerves
- Rectus sheath – formation, contents, linea alba and linea semilunaris
- Inguinal canal – extent, boundaries, contents of inguinal canal, Hesselbach's triangle
- Anatomical basis of inguinal hernia
- Attachments of muscles of anterior abdominal wall
- Common abdominal incisions*
- Umbilicus – position, dermatome and applied aspects*

Topic: Posterior abdominal wall (AN45.1 to AN45.3)

- Thoracolumbar fascia
- Lumbar plexus – root value, formation and branches
- Other nerve plexuses of posterior abdominal wall*
- Major subgroups of back muscles, nerve supply and action*

Topic: Male external genitalia (AN46.1 to AN46.5)

- Testes – coverings, internal structure, side determination, blood supply, nerve supply and lymphatic drainage
- Descent of testis with its applied anatomy
- Parts of epididymis
- Penis – parts, components, blood supply and lymphatic drainage
- Anatomical basis of varicocoele*
- Anatomical basis of phimosis and circumcision*
- Spermatic cord and its contents

Topic: Abdominal cavity (AN47.1 to AN47.14)

- Greater and lesser sac – boundaries and recesses
- Naming and identification of peritoneal folds and pouches
- Anatomical basis of ascites, peritonitis and subphrenic abscess*
- Spleen – anatomical position, external features, peritoneal and visceral relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Anatomical basis of splenic notch, accessory spleens and Kehr's sign*
- Coeliac trunk – origin, course, important relations and branches
- Abdominal part of oesophagus – anatomical position, blood supply, nerve supply, lymphatic drainage and applied aspects

- Stomach – anatomical position, external features, peritoneal and visceral relations, blood supply, nerve supply, lymphatic drainage and applied anatomy
- Anatomical basis of lymphatic spread in carcinoma stomach and different types of vagotomy*
- Mesentery – extent, borders, contents, relations and applied aspects
- Small Intestine – parts, macroscopic difference between jejunum and ileum, nerve supply and lymphatic drainage
- Superior mesenteric artery – origin, course, termination, important relations and branches
- Large intestine – features, extent, peritoneal and other relations
- Caecum – anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Vermiform appendix – anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Inferior mesenteric artery – origin, course, important relations and branches
- Duodenum – anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Pancreas – anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Liver and extrahepatic biliary apparatus – anatomical position, external features, important peritoneal relations and visceral relations, blood supply, nerve supply, lymphatic drainage and applied aspects

- Clinical importance of Calot's triangle*
- Anatomical basis of site of needle puncture in liver biopsy, referred pain in cholecystitis and obstructive jaundice*
- Portal vein – formation, course, relations, tributaries and sites of porta systemic

  anastomoses
- Anatomical basis of haematemesis and caput medusae in portal hypertension
- Kidneys – anatomical position, side determination, coverings, external features, important visceral relations, blood supply, nerve supply, lymphatic drainage and applied anatomy
- Anatomical basis of radiating pain of kidney to groin*
- Ureter – extent, parts, course, relations, constrictions, blood supply, nerve supply, lymphatic drainage and applied aspects
- Suprarenal gland – anatomical position, coverings, external features, important visceral and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Thoraco abdominal diaphragm – attachments, major and minor openings, nerve supply and actions
- Thoraco abdominal diaphragm – abnormal openings and diaphragmatic hernia*
- Abdominal aorta – origin, course, important relations and branches
- Inferior vena cava – formation, course, relations and tributaries

Topic: Pelvic wall and viscera (AN48.1 to AN48.8)

- Muscles of pelvic diaphragm
- Position, features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and clinical aspects of important male and female pelvic viscera

- Origin, course, important relations and branches of internal iliac artery
- Branches of sacral plexus
- Anatomical basis of suprapubic cystostomy, urinary obstruction in benign prostatic hypertrophy, retroverted uterus, prolapse uterus, internal and external haemorrhoids, anal fistula, vasectomy, tubal pregnancy and tubal ligation*
- Neurological basis of automatic bladder*
- Lobes involved in benign prostatic hypertrophy and prostate cancer*
- Structures palpable during vaginal and rectal examination*

Topic: Perineum (AN49.1 to AN49.5)

- Boundaries and contents of superficial and deep perineal pouch
- Perineal body – identification and description
- Perineal membrane in male and female
- Ischiorectal fossa – boundaries, contents and applied anatomy
- Anatomical basis of perineal tear, episiotomy, perianal abscess and anal fissure*

Topic: Vertebral column (AN50.1 to AN50.4)

- Curvatures of the vertebral column
- Type, articular ends, ligaments and movements of intervertebral joints, sacroiliac joints and pubic symphysis
- Site, direction of the needle and structures pierced during lumbar puncture
- Anatomical basis of scoliosis, lordosis, prolapsed disc, spondylolisthesis and spina bifida*

Topic: Sectional Anatomy of Abdomen and Pelvis (AN51.1, AN51.2)

- Cross sections at T8, T10 and L1 (transpyloric plane) levels
- Midsagittal section of male and female pelvis

Topic: Histology and embryology (AN52.1 to AN52.8)

- Microstructure of oesophagus, cardiooesophageal junction*, fundus of stomach, pylorus of stomach
- Microstructure of duodenum, jejunum, ileum
- Microstructure of colon, appendix
- Microstructure of liver, gallbladder, pancreas
- Microstructure of kidney, ureter, suprarenal gland
- Microstructure of testis, epididymis, vas deferens, penis, prostate gland
- Microstructure of ovary, uterus, uterine tube, cervix*, placenta, umbilical cord, corpus luteum*
- Development of anterior abdominal wall*
- Development and congenital anomalies of diaphragm
- Development and congenital anomalies of foregut
- Development and congenital anomalies of midgut
- Development and congenital anomalies of hindgut
- Development of urinary system
- Development of male reproductive system
- Development of female reproductive system

Topic: Osteology (AN53.1 to AN53.4)

- Lumbar vertebrae – anatomical position, salient features, articulations and attachments of muscle groups
- Sacrum and coccyx – anatomical position, salient features, articulations and attachments of muscle groups
- Bony pelvis – anatomical position, boundaries of pelvic inlet, pelvic cavity and pelvic outlet,
- True and false pelvis with sex differences
- Clinical importance – sacralization of lumbar vertebra, lumbarization of 1st sacral vertebra, types of bony pelvis*

Topic: Radiological anatomy (AN 54.1 to AN54.3)

- Features of plain X ray abdomen
- Contrast X ray barium swallow, barium meal, barium enema
- Cholecystography
- Intravenous and Retrograde pyelography
- Hysterosalpingography
- ERCP*
- CT abdomen*
- MRI abdomen and pelvis*
- Abdominal arteriography*

H. LOWER LIMB

Topic: Features of individual bones (lower limb) (AN 14.1 – 14.4)

- Hip bone, femur, patella, tibia, fibula – side determination, anatomical position and important features
- Joints formed by the given bone
- Muscle group attachments on above bones

- Importance of ossification of lower end of femur and upper end of tibia
- Identification and naming of bones in articulated foot with individual muscle attachments*

Topic: Front & Medial Side of Thigh (AN15.1 to AN15.5)

- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels of anterior thigh
- Major muscles with their attachment, nerve supply and actions
- Femoral triangle – boundaries and contents
- Anatomical basis of psoas abscess & femoral hernia*
- Adductor canal – boundaries and contents

Topic: Gluteal region & Back of thigh (AN16.1 to AN16.6)

- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels of gluteal region
- Major muscles with their attachment, nerve supply and actions
- Anatomical basis of sciatic nerve injury during gluteal intramuscular injections
- Anatomical basis of Trendelenburg sign
- Hamstring group of muscles with their attachment, nerve supply and actions
- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels on the back of thigh
- Popliteal fossa – boundaries, roof, floor, contents and relations

Topic: Hip joint (AN17.1 to AN17.3)

- Type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply, bursae around the hip joint

- Anatomical basis of complications of fracture neck of femur*
- Dislocation of hip joint and surgical hip replacement*

Topic: Knee joint, Antero lateral compartment of leg & Dorsum of foot (AN18.1 to AN18.7)

- Major muscles of anterolateral compartment of leg with their attachment, nerve supply and actions
- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels of anterolateral compartment of leg
- Anatomical basis of foot drop
- Type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply, bursae around the knee joint
- Anatomical basis of locking and unlocking of the knee joint
- Anatomical basis of knee joint injuries*
- Anatomical basis of osteoarthritis*

Topic: Back of leg & Sole (AN19.1 to AN19.7)

- Major muscles of back of leg with their attachment, nerve supply and actions
- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels of back of leg
- Concept of "peripheral heart"
- Sole – layers, muscles, vessels and nerves
- Anatomical basis of rupture of calcaneal tendon*
- Factors maintaining arches of the foot and their importance
- Anatomical basis of flat foot and club foot*
- Anatomical basis of metatarsalgia and plantar fasciitis*

Topic: General features, Joints, Radiographs & Living Anatomy (AN 20.1 – 20.10)

- Tibiofibular and ankle joints – type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply
- Subtalar and transverse tarsal joints*
- Fascia lata, venous drainage, lymphatic drainage, retinacula and dermatomes of lower limb
- Anatomical basis of enlarged inguinal lymph nodes*
- Anatomical basis of varicose veins and deep vein thrombosis
- Bones and joints of lower limb seen in anteroposterior and lateral view radiographs of various regions of lower limb
- Palpation of arterial pulses in a simulated environment – femoral, popliteal, anterior tibial, posterior tibial and dorsalis pedis arteries
- Basic concept of development of lower limb*

I. HEAD AND NECK

Topic: Skull osteology (AN26.1 to AN26.7)

- Anatomical position of skull
- Identification and naming of individual skull bones
- Features of norma frontalis, verticalis, occipitalis, lateralis and basalis
- Cranial cavity – subdivisions, foramina and structures passing through them
- Morphological features of mandible
- Features of typical and atypical cervical vertebrae (atlas and axis)
- Concept of membranous ossification*
- Features of the 7th cervical vertebra*

Topic: Scalp (AN27.1 and AN27.2)

- Scalp – layers, blood supply, nerve supply and surgical importance
- Emissary veins and their role in spread of infection from extracranial route to intracranial venous sinuses

Topic: Face and parotid region (AN28.1 to AN28.10)

- Muscles of facial expression and their nerve supply
- Sensory innervation of face
- Origin / formation, course, branches / tributaries of facial vessels
- Branches of facial nerve with distribution
- Cervical lymph nodes and lymphatic drainage of head, face and neck
- Superficial muscles of face, their nerve supply and actions
- Anatomical basis of facial nerve palsy
- Surgical importance of deep facial vein
- Parotid gland – parts, borders, surfaces, contents, relations, nerve supply, course of its duct and surgical importance
- Anatomical basis of Frey's syndrome*

Topic: Posterior triangle of neck (AN29.1 to AN29.4)

- Sternocleidomastoid muscle – attachments, nerve supply, relations and actions
- Anatomical basis of Erb's and Klumpke's palsy
- Anatomical basis of wry neck*
- Attachments of inferior belly of omohyoid, scalenus anterior, scalenus medius and levator scapulae*

Topic: Cranial cavity (AN30.1 to AN30.5)

- Cranial fossae and related structures
- Major foramina with structures passing through them
- Identification and description of dural folds and dural venous sinuses
- Clinical importance of dural venous sinuses
- Effect of pituitary tumours on visual pathway*

Topic: Orbit (AN31.1 to AN31.5)

- Extraocular muscles – demonstration and description
- Nerves and vessels in the orbit – demonstration and description
- Anatomical basis of Horner's syndrome*
- Components of lacrimal apparatus
- Anatomical basis of oculomotor, trochlear and abducent nerve palsies along with strabismus

Topic: Anterior triangle of neck (AN32.1 and AN32.2)

- Boundaries and subdivisions of anterior triangle
- Boundaries and contents of muscular, carotid, digastric and submental triangles

Topic: Temporal and infratemporal region (AN33.1 to AN33.5)

- Temporal and infratemporal fossae – extent, boundaries and contents
- Muscles of mastication – attachments, direction of fibres, nerve supply and actions
- Temporomandibular joint – articulating surface, type and movements
- Clinical significance of pterygoid venous plexus
- Features of dislocation of temporomandibular joint*

Topic: Submandibular region (AN34.1 and AN34.2)

- Submandibular salivary gland – morphology, relations and nerve supply including submandibular ganglion
- Anatomical basis of formation of submandibular stones*

Topic: Deep structures in the neck (AN35.1 to AN35.10)

- Deep cervical fascia – parts, extent, attachments and modifications
- Thyroid gland – location, parts, borders, surfaces, relations and blood supply
- Subclavian artery – origin, parts, course and branches
- Internal jugular and brachiocephalic veins – formation, course, relations, tributaries and termination
- Cervical lymph nodes – extent, drainage and applied anatomy
- Cervical sympathetic chain – extent, formation, relation and branches
- IX, X, XI and XII cranial nerves – course and branches in the neck
- Anatomical basic of clinical features of thyroid swellings*
- Anatomical basis of clinical features of compression of subclavian artery and lower trunk of brachial plexus by cervical rib*
- Fascial spaces of neck*

Topic: Mouth, pharynx and palate (AN36.1 to AN36.5)

- Palatine tonsil – morphology, relations, blood supply and applied anatomy
- Composition of soft palate
- Waldeyer's lymphatic ring – components and functions
- Pyriform fossa – boundaries and clinical significance*

- Anatomical basis of tonsillitis, tonsillectomy, adenoids and peri tonsillar abscess*
- Clinical significance of Killian's dehiscence*

Topic: Cavity of nose (AN37.1 to AN37.3)

- Nasal septum and lateral wall of nose – features, blood supply and nerve supply
- Paranasal sinuses – location and functional anatomy
- Anatomical basis of sinusitis and maxillary sinus tumours*

Topic: Larynx (AN38.1 to AN38.3)

- Larynx – morphology, structure of the walls, nerve supply, blood supply and actions of intrinsic and extrinsic muscles
- Anatomical aspects of laryngitis*
- Anatomical basis of recurrent laryngeal nerve injury*

Topic: Tongue (AN39.1 and AN39.2)

- Tongue – morphology, nerve supply, embryological basis of nerve supply, blood supply, lymphatic drainage and actions of extrinsic and intrinsic muscles
- Anatomical basis of hypoglossal nerve palsy*

Topic: Organs of hearing and equilibrium (AN40.1 to AN40.5)

- External ear – parts, blood supply and nerve supply
- Middle ear and auditory tube – boundaries, contents, relations and functional anatomy
- Features of internal ear*
- Anatomical basis of otitis externa and otitis media*
- Anatomical basis of myringotomy*

Topic: Eyeball (AN41.1 to AN41.3)

- Eyeball – parts and layers
- Anatomical aspects of cataract, glaucoma and central retinal artery occlusion*
- Intraocular muscles – position, nerve supply and actions*

Topic: Back region (AN42.1 to AN42.3)

- Contents of the vertebral canal
- Suboccipital triangle – boundaries and contents
- Semispinalis capitis and splenius capitis – position, direction of fibres, relations, nerve supply and actions*

Topic: Head and Neck Joints, Histology, Development, Radiography and Living Anatomy (AN43.1 to AN43.9)

- Atlantooccipital joint and atlantoaxial joint – movements with muscles producing them
- Microanatomy of – pituitary gland, thyroid gland, parathyroid gland, tongue, salivary glands, tonsil, epiglottis, cornea and retina
- Microanatomy of – olfactory epithelium, eyelid, lip, sclero corneal junction, optic nerve, cochlea, organ of Corti and pineal gland*
- Development and developmental basis of – congenital anomalies of face, palate, tongue, branchial apparatus, pituitary gland, thyroid gland and eye
- Testing of muscles of facial expression, extraocular muscles and muscles of mastication,
- Palpation of arteries – carotid, facial and superficial temporal arteries
- Location of hyoid bone, thyroid cartilage and cricoid cartilage with their vertebral levels

- Identify the anatomical structures in 1) Plain X ray skull – AP and lateral view; 2) Plain X ray cervical spine AP and lateral view; 3) Plain X ray of paranasal sinuses
- Carotid and vertebral angiograms – anatomical route and anatomical structures*

J. NEUROANATOMY

Topic: Meninges and CSF (AN56.1 and AN56.2)

- Meninges – layers with their extent and modifications
- Circulation of CSF with its applied anatomy

Topic: Spinal cord (AN57.1 to AN57.5)

- Spinal cord – external features, extent in child and adult with its clinical implications
- Transverse section of spinal cord at mid cervical and mid thoracic level
- Ascending and descending tracts at mid thoracic level of spinal cord
- Anatomical basis of syringomyelia*

Topic: Medulla oblongata (AN58.1 to AN58.4)

- Medulla oblongata – external features
- Transverse section of medulla oblongata at the level of 1) pyramidal decussation; 2) sensory decussation; 3) inferior olivary nucleus
- Cranial nerve nuclei in medulla oblongata with their functional components
- Anatomical basis and effects of medial and lateral medullary syndrome*

Topic: Pons (AN59.1 to AN59.3)

- Pons – external features
- Transverse section of pons at the upper and lower level
- Cranial nerve nuclei in pons with their functional components

Topic: Cerebellum (AN60.1 to AN60.3)

- Cerebellum – external and internal features
- Connections of cerebellar cortex and intracerebellar nuclei
- Anatomical basis of cerebellar dysfunction*

Topic: Midbrain (AN61.1 to AN61.3)

- Midbrain – external and internal features
- Internal features of midbrain at the level of superior and inferior colliculus
- Anatomical basis and effects of Benedikt's and Weber's syndrome*

Topic: Cranial nerve nuclei and cerebral hemispheres (AN62.1 to AN62.6)

- Cranial nerve nuclei with their functional components
- Cerebral hemispheres – poles, surfaces, sulci, gyri and functional areas
- White matter of cerebrum
- Basal ganglia and limbic lobe – parts and major connections
- Dorsal thalamus, hypothalamus, epithalamus, metathalamus and subthalamus boundaries, parts, gross relations, major nuclei and connections
- Circle of Willis – formation, branches and major areas of distribution

Topic: Ventricular system (AN63.1 and AN63.2)

- Lateral, 3rd and 4th and ventricles – parts, boundaries and features
- Anatomical basis of congenital hydrocephalus*

Topic: Histology and Embryology (AN64.1 to AN64.3)

- Microanatomical features of spinal cord, cerebellum and cerebrum
- Development of neural tube, spinal cord, medulla oblongata, pons, midbrain, cerebral hemispheres and cerebellum
- Various types of open neural tube defects with their embryological basis*

K. ETHICS IN ANATOMY – AN82.1

- Demonstrate respect and follow the correct procedure when handling cadavers and other biologic tissue

L. LIVING ANATOMY

i) UPPER LIMB :

BONY LANDMARKS (PALPATION OF):

Clavicle , spine of scapula, inferior angle of scapula, coracoid process of the scapula, epicondyles of humerus, olecranon process of ulna ;

JOINTS (DEMONSTRATION OF MOVEMENTS): Shoulder joint, shoulder girdle, elbow joint, radio-ulnar joint (Superior & inferior), wrist joint, 1st carpo-metacarpal joint, MP (Metacarpo phalangeal joint) and IP (Interphalangeal joints) joints.

MUSCLES (DEMONSTRATION OF ACTION) :

Principle of testing: trapezius, serratus anterior, latissimus dorsi, pectoralis major, deltoid, biceps brachii, brachialis, extensors of elbow, supinators, wrist extensors, wrist flexors, small muscles of hand.

NERVES: Palpation of Ulnar nerve behind the medial epicondyle of humerus

VESSELS (Pulsation of): brachial artery, radial artery

OTHERS: Anatomical snuff box (boundaries)

ii) LOWER LIMB:

BONY LANDMARKS (PALPATION OF): anterior superior iliac spine and iliac crest of hip bone, greater trochanter and adductor tubercle of femur, head and neck of fibula, medial and lateral malleoli of tibia and fibula, tibial tuberosity, subcutaneous Living of tibia, patella.

JOINTS (DEMONSTRATION OF MOVEMENTS): Hip, knee, ankle and subtalar joints.

MUSCLES (DEMONSTRATION OF ACTION): Hip flexors and extensors, abductors, adductors.

Knee: Flexors and extensors

Ankle: Dosiflexors and plantar flexors

Subtalar: Invertors and evertors

NERVES: Palpation of common peroneal nerve

VESSELS (Pulsation of): Femoral artery, popliteal artery, dorsalis pedis artery, posterior tibial artery

OTHERS: Palpation of ligamentum patellae and iliotibial tract.

iii) ABDOMEN

BONY LANDMARKS (PALPATION OF): Anterior superior iliac spine of hipbone

JOINTS (DEMONSTRATION OF MOVEMENTS): Intervertebral joints

MUSCLES (DEMONSTRATION OF ACTION): Oblique muscles of abdomen, Transversus abdominis, Rectus abdominis

NERVES: Dermatome T10

OTHERS: Enlarged liver, spleen, bimanual palpation of kidney, abdominal quadrants and regions. Position of superficial and deep inguinal rings. Demonstration of renal angle and surface marking of Mc.Burney's point and importance.

iv) THORAX :

BONY LANDMARKS (PALPATION OF): Sternal angle, counting of rib spaces locating thoracic spines

JOINTS (DEMONSTRATION OF MOVEMENTS): Intervertebral joints

MUSCLES (DEMONSTRATION OF ACTION): Respiratory movements

OTHERS: Palpation of apex beat, apices of the lungs and triangle of auscultation

v) HEAD FACE NECK :

BONY LANDMARKS (PALPATION OF): Nasion, Glabella, inion, mastoid process, suprameatal triangle, zygoma, zygomatic arch, angle of mandible, Head of mandible

JOINTS (DEMONSTRATION OF MOVEMENTS):
Temporomandibular joint

MUSCLES (DEMONSTRATION OF ACTION): of mastication muscles and action of facial muscles.

VESSELS (PULSATION OF): Facial artery

PALPATION OF: Symhysis menti, hyoid bone, thyroid cartilage, Trachial rings, suprasternal notch, spine of C7

JOINTS (DEMONSTRATION OF MOVEMENTS): Atlanto-occipital and atlanto axial joints, cervical joints

MUSCLES (DEMONSTRATION OF ACTION): Sternocleidomastoid, Neck flexors and extensors

VESSELS (PULSATION OF): Common carotid artery, external carotid artery

OTHERS: Palpation of Thyroid gland.

Summary of time allotted, teaching and learning methods and student assessment

TIME ALLOTTED

Curricular component	Time allotted in hours
Lectures	220
Smallgroupteaching/tutorials/integrated learning /practical	415
Self-directed learning	40
Early clinical exposure (basic science correlation and clinical skills)	30
AETCOM module 5 & 4	12
Formative assessment and term examinations	43
Total	**760**

INTEGRATION: From the integrated teaching of other basic sciences, student 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

EARLY CLINICAL EXPOSURE

Objectives of Early Clinical Exposure:

The objectives of Early Clinical Exposure of the first-year medical learners are to enable the learner to:

(a) Recognize the relevance of basic sciences in diagnosis, patient care and treatment.

(b) Provide a context that will enhance basic science learning.

(c) Relate to experience of patients as a motivation to learn.

(d) Recognize attitude, ethics and professionalism as integral to the doctor patient relationship.

(e) Understand the socio-cultural context of diseases through the study of humanities.

Elements of ECE:

The three elements of ECE are:

1. Provision of clinical correlation to basic sciences learning.
2. Provision of authentic human contact in a social or clinical context that enhances learning in the early/pre-clinical years of undergraduate education.
3. Introduction to humanities in medicine

Salient Principles:

The key principles underlying early clinical exposure are providing a clinical context and ensuring patient centricity. Early clinical exposure provides for the three key elements listed above. The clinical context can include case scenario, videos, actual patient, simulated patient etc. The presence of actual patients in every session of ECE, though not essential, is preferred. Therefore, ECE is exposure to the relevant clinical context in earlier years. It must be noted that purpose of ECE is not to prepone the conventional clinical teaching but to provide better understanding of basic sciences through a clinical context.

Sl. No.	Topic	Dept. concerned	Setting
1.	**IVF**	OBG	Classroom
2.	**Joints**	Orthopedics	Classroom
3.	**Varicose Veins**	Surgery	Classroom
4.	**Hydrocephalus**	Pediatrics	Classroom
5.	**Bell's Palsy**	Medicine	Classroom
6.	**Thyroid enlargement**	Medicine	Classroom
7.	**Cataract**	Community medicine	PHC
8.	**Pleural Effusion**	Medicine	Hospital visit
9.	**Inguinal Hernia**	Surgery	Hospital visit
10.	**Ascites**	Medicine	Hospital visit

SELF DIRECTED LEARNING -

Forty hours of dedicated time for SDL is provided for anatomy in the first phase.

Scheme of Examination

Scheme of Examination- Formative Assessment –Theory

Theory	Marks	Reduced to
I IA	100	50
II IA	100	
III I A (Prelim)	200	
Part completion test (8 test) and log book	100 (80+20)	10
Final I A Marks to be sent to University		60

Scheme of Examination- Formative Assessment – Practical

Practical (Practical +Viva)	Marks	Reduced to
I IA	50	30
II IA	50	
III I A (Prelim)	100	
Early clinical exposure	50	5
Skill Certification	50	5
Final I A Marks to be sent to University		40

- Minimum of three internal examination are conducted
- The preliminary examination preceding the university exam shall be similar to the pattern of university exam
- Best of one of (I IA and II IA) and Preliminary examination will be considered for calculation of final I A
- **Final IA marks will reflect as separate head of passing at the university examination**

ELIGIBILITY FOR EXAMINATION :

To be eligible to appear for university examination a candidate

- Shall have undergone satisfactorily the approved course of study in the subject for the prescribed duration
- Shall have attended minimum 75% of the total number of classes in theory and 80% in practical separately to become eligible to appear for the examination in that subject
- Shall secure 40% of total marks separately assigned for internal assessment in theory and practical in a particular subject
- Shall secure 50% marks in aggregate of the total marks combined in theory and practical assigned for I A in particular subject

Instantaneous Examination :

- To be conducted not later than 90 days after the declaration of the results of the final examination

SCHEME OF FINAL UNIVERSITY EXAMINATION- SUBJECT AND DISTRIBUTION OF MARKS

Sl NO	THEORY	ANATOMY	PHYSIOLOGY	BIOCHEMISTRY
1	NO OF PAPERS -02	PAPER I PAPER II	PAPER I PAPER II	PAPER I PAPER II
	MAX MARKS	2X100 = 200	2X100 = 200	2X100 = 200
	TOTAL THEORY	**200**	**200**	**200**
2	**PRACTICAL**	80	80	80
	VIVA VOCE	20	20	20
	TOTAL PRACTICAL	**100**	**100**	**100**

TYPE, NUMBER OF QUESTION AND DISTRIBUTION OF MARKS FOR THEORY PAPER

TYPE OF QUESTION	NUMBER OF QUESTION	MARKS FOR EACH QUESTION	TOTAL MARKS
MCQ	20	1	20
LONG ESSAY	2	10	20
SHORT ESSAY	9	5	45
SHORT ANSWER	5	3	15
Total			**100**

TYPE, NUMBER OF QUESTION AND DISTRIBUTION OF MARKS FOR PRACTICAL

TYPE OF QUESTION	NUMBER OF QUESTION	MARKS FOR EACH QUESTION	TOTAL MARKS
Gross Practical			
Gross Spotters	5	2	10
Gross discussion	2 (Abovediaphragm-1 And Below diaphragm-1)	15	30
Living anatomy	1	10	10
		Total	50
Histology Practical			
Histology Spotters	10 (Histology slides-9 and Genetic chart-1)	1	10
Slide discussion	2 (General histology-1 and Systemic histology-1)	10	20
		Total	30
Viva-voce			
Osteology& soft parts – (Above diaphragm)	-	-	5
Osteology & Soft parts - (Below diaphragm)	-	-	5
Radiological anatomy	-	-	5
Embryology models	-	-	5
		Total	20
Final Total of Practical exam			**100**

CRITERIA FOR PASS IN UNIVERSITY EXAMINATION

- **For declaration of pass in any subject in the university examination a candidate shall pass both theory and practical components separately in the same examination as stipulated below.**

- **For a pass in theory examination for each subject a student must secure minimum 40% of marks in each of the two theory papers with minimum 50% of marks in aggregate (both papers together).**
- **For a pass in Practical Examination for each subject a student must secure minimum 50% of marks in aggregate in practical and viva voce examination.**
- **Internal assessment shall be reflected as a separated head of passing at the final university examination.**
- **For a pass in subject, a student shall secure 50% marks in aggregate Of the total marks combined in theory, Practical and viva voce.**

Blue Print for theory examinations

PAPER - I*

Distribution of Portion for Theory Paper-I will be as follows:

Chapter / Topic	Type & No. of Questions	Marks
All relevant topics	M.C.Q. 20	20
Head & Neck, Brain and Spinal cord, Thorax including diaphragm , Upper limb	Long Essay 2x10	20
Head & Neck, Brain and Spinal cord, Thorax including Diaphragm , Upper limb , GeneralAnatomy, General Histology and Relevant Systemic Histology, General Embryology and Relevant Systemic Embryology	Short Essays 9x5	45
General Anatomy, General Histology and Relevant Systemic Histology, General Embryologyand Relevant Systemic Embryology andalso Head & Neck, Brain and Spinal cord, Thorax including diaphragm and Upper limb	Short Answer 5x3	15
	TOTAL	100

*** A strict division of the topic may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.**

PAPER - II*

Distribution of Portion for Theory Paper-II will be as follows:

Chapter / Topic	Type & No. of Questions	Marks
All relevant topics	M.C.Q. 20	20
Gross Anatomy of Abdomen, Pelvis, perineum and Lower limb	Long Essay 2x10	20
Gross Anatomy of Abdomen, Pelvis, perineum , Lower limb, Relevant Systemic Embryology & Relevant Systemic Histology and Genetics	Short Essays 9x5	45
Relevant Systemic Histology, Relevant Systemic Embryology, Genetics and also Abdomen,Pelvis, perineum and Lower limb	Short Answer 5x3	15
	TOTAL	100

*** A strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.**

List of Histology Slides

General histology	Systemic histology	
1. Epithelial tissue	1. Breast	35. Cornea
2. Connective tissue	2. Lung	36. Retina
3. Serous salivary gland	3. Trachea	37. Spinalcord
4. Mucous salivary gland	4. Oesophagus	38. Cerebellum
5. Mixed salivary gland	5. Stomach fundus	39. Cerebrum
6. Hyaline cartilage	6. Stomach pylorus	
7. White fibrocartilage	7. Duodenum	
8. Elastic cartilage	8. Jejunum	
9. TS of compact bone	9. Ileum	
10. LS of compact bone	10. Large intestine	
11. TS of skeletal muscle	11. Appendix	
12. LS of Skeletal muscle	12. Liver	
13. Cardiac muscle	13. Gall bladder	
14. Large artery	14. Pancreas	
15. Large vein	15. Kidney	
16. Medium sized artery	16. Ureter	
17. Medium sized vein	17. Urinary bladder	
18. Lymph node	18. Testis	
19. Thymus	19. Epididymis	
20. Palatine Tonsil	20. Vas deferens	
21. Spleen	21. Prostate	
22. Peripheral nerve TS	22. Ovary	
23. Peripheral nerve LS	23. Fallopian tube	
24. Sensory ganglia	24. Uterus	
25. Autonomic ganglia	25. Cervix	
26. Thick skin	26. Placenta	
27. Thin skin	27. Umbilical cord	
	28. Lip*	
	29. Tongue	
	30. Epiglottis	
	31. Pituitary gland	
	32. Thyroid	
	33. Parathyroid gland	
	34. Adrenal gland	

LIST OF RECOMMENDED BOOKS

General anatomy

- Handbook of General Anatomy, BD Chaurasia / General Anatomy, Vishram Singh

Histology

- diFiore's Atlas of Human Histology with Functional Correlation, Victor P Eroschenko / Wheater¹s Functional Histology: A Text and Colour Atlas
- Textbook of Human Histology with colour Atlas, Inderbir Singh / Textbook of Histology and Practical Guide, Gunasegaran / Histology: Text and Atlas, Brijesh Kumar

Embryology

- Textbook of Human Embryology, Inderbir Singh / Langman¹s textbook of Medical Embryology, TW Sadler

Human genetics

- Human Genetics, SD Gangane / Medical Genetics, GP Pal / Emery's Elements of Human Genetics, Peter Turnpenny and Sian Ellard

Gross anatomy including neuroanatomy

- Cunningham's Manual of Practical Anatomy Volumes I,II and III
- BD Chaurasia's / Dutta's / Vishram Singh's Textbook of Anatomy – all volumes
- Grant's atlas / McMinn's atlas / Netter's atlas
- Clinically Oriented Anatomy, K L Moore / Clinical Anatomy by Regions, Richard Snell / Clinical Anatomy (A Problem Solving Approach) (2 volumes), Neeta Kulkarni
- Gray¹s Anatomy for Students, South Asia Edition

- Clinical Neuroanatomy, Richard Snell / Textbook of Neuroanatomy, IB Singh / Textbook of Clinical Neuroanatomy, Vishram Singh

Surface and radiological anatomy

- Surface and radiological anatomy, A Halim / Surface and radiological anatomy, Ashwini Appaji and Roopa Kulkarni

Others

- Stedman's Medical Dictionary
- Gray[1]s Anatomy The Anatomical Basis of Clinical Practice

PHYSIOLOGY

PHYSIOLOGY

I. GOAL:

The goal of teaching undergraduate students in physiology is to make them understand the physiological principles and normal homeostatic mechanisms of normal human body so that he/she can understand the disease pattern better.

II. OBJECTIVES:

A) KNOWLEDGE:

At the end of the courses, the student will be able to:

1. Describe the normal functioning of all the organ systems, regulatory mechanisms and interactions of the various organs for well coordinated total body function.
2. Understand the basic principles, mechanisms and homeostatic control of all the functions of human body as a whole.
3. Elucidate the physiological aspect of normal growth and development.
4. Analyse the physiological responses and adaptation of different stresses during life processes.
5. Lay emphasis on applied aspect of physiological functions underlying disease state.
6. Correlate knowledge of physiology in areas indicated by National Health Programs.

B) SKILLS:

Acquire the following skills:

1. To do the experiments for study of physiological function.
2. Interpret experimental and investigative data.
3. Distinguish between normal and abnormal data derived as a result of tests which he / she 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 the regulatory mechanisms.

TEACHING HOURS AND METHODS:\

Theory	160 Hours
Non-lecture teaching (small group teaching/tutorials/integrated learning/practical)	310 Hours
Self directed learning (SDL)	25 Hours
Total	**495 Hours**
Early clinical exposure	30 Hours
Grand total	**525 Hours**

ATTENDANCE

Every candidate must have attendance minimum of 75% of the total classes conducted in theory and 80% in practical separately . Each candidate also must have 75% minimum attendance separately in self directed learning(SDL) , Early clinical exposure (ECE) , small group teaching (SGT) / Tutorial / Integrated teaching and AETCOM in each calendar year calculated from date of commencement of academic session to the last working day as notified by the university in each of the subjects to be eligible to appear for university examination.

SUBMISSION OF LOG BOOK & LABORATORY RECORD NOTE BOOK

At the time of Practical Examination, each candidate shall submit to the Examiners

his/ her log book & laboratory notebook duly certified by the Head of the Department as a bonafide record of the work done by the candidate.

COURSE CONTENTS

List of systems included in Physiology:

- General Physiology
- Haematology
- Nerve and Muscle Physiology
- Gastrointestinal Physiology
- Cardiovascular Physiology
- Respiratory Physiology

- Renal Physiology
- Endocrine Physiology
- Reproductive Physiology
- Neurophysiology (Nervous System and Special Senses)
- Integrated Physiology

Theory **160 Hours**

1. General Physiology PY 1.1 to 1.9 **8 Hours**

Structure and functions of a mammalian cell. Homeostasis. Intercellular communications. Apoptosis. Transport mechanisms across cell membranes. Fluid compartments of the body. pH and Buffer systems in the body. Resting membrane potential and Action potential. Evaluation of functions of the cells and its products, its communications and their applications in clinical care and research.

2. Haematology PY 2.1 to 2.13 **16 Hours**

Composition and functions of blood components. Plasma Proteins- origin, forms, variations and functions. RBC- formation (erythropoiesis) and its regulation, morphology, functions and variations. Haemoglobin- synthesis, variants, functions and its breakdown. Anaemia and Jaundice- definition and classification. WBC- formation and its regulation, morphology, functions and variations. Immunity – types, mechanism and regulation. Platelets- formation and its regulation, morphology, functions and variations. Haemostasis. Anticoagulants. Bleeding and Clotting disorders (haemophilia and purpura). Blood groups. Blood banking and transfusion. Rh incompatibility. Lymph- composition, circulation and functions.

3. Nerve and Muscle Physiology PY 3.1 to 3.18 **8 Hours**

Neuron and neuroglia- structure, types and functions. Nerve fibres- classification, functions & properties. Nerve injuries- degeneration and regeneration in peripheral nerves. Neuromuscular junction- structure and transmission of impulses. Neuromuscular blocking agents. Myasthenia gravis. Muscle fibres: types, structure and functions. Action potential in nerve, skeletal & smooth muscles. Muscle contraction- molecular basis (skeletal and smooth), Isotonic and Isometric contraction. Energy sources and metabolism. Gradation of muscular activity. Muscle dystrophy- Myopathies. Strength-duration curve.

4. Gastrointestinal Physiology PY 4.1 to 4.10 — 12 Hours

Physiological anatomy of digestive system. Enteric nervous system. GI Secretions- composition, mechanism of secretion, functions and regulation of secretion of saliva, gastric, pancreatic, intestinal juices and bile. GIT movements- types, regulation and functions. Defecation reflex. Role of dietary fibres. Digestion and absorption of nutrients. GIT hormones- source, regulation and functions. Gut-brain axis. Structure and functions of liver and gall bladder. Gastric function tests, pancreatic exocrine function tests & liver function tests. Pathophysiology of achalasia cardia, peptic ulcer, gastro-oesophageal reflux disease, vomiting, diarrhoea, constipation, adynamic ileus, Hirschsprung's disease.

5. Cardiovascular Physiology PY 5.1 to 5.16 — 25 Hours

Functional anatomy of heart. Properties of cardiac muscle- morphological, electrical, mechanical and metabolic. Pacemaker and conducting system. Cardiac impulse-generation and conduction. Cardiac cycle. Electrocardiography- basics, normal ECG, uses and cardiac axis. Abnormal ECG- arrythmias, heart block and myocardial infarction. Haemodynamics of circulatory system. Local and systemic cardiovascular regulatory mechanisms. Heart rate- factors affecting. Cardiac output- factors affecting, regulation and measurement. Blood pressure- components, determinants, factors affecting, regulation and applied aspects. Regional circulation- microcirculation, lymphatic circulation, coronary, cerebral, capillary, skin, pulmonary, splanchnic and foetal circulation. Pathophysiology of shock, syncope, heart failure and coronary artery disease.

6. Respiratory Physiology PY 6.1 to 6.10 — 10 Hours

Functional anatomy of respiratory tract. Mechanics of respiration- Mechanism of ventilation; Pressure and volume changes; Alveolar surface tension; surfactant (source, chemical nature, functions) and hyaline membrane disease; Compliance; Airway resistance; Dead space; Alveolar ventilation; Ventilation-perfusion ratio; Diffusion capacity of lungs, Lung volumes and capacities – definition, normal values, determination and significance.

Transport of respiratory gases- Oxygen and Carbon dioxide.

Neural and Chemical regulation of respiration.

Physiology of high altitude and deep sea diving. Principles of artificial respiration and

oxygen therapy. Pathophysiology of hypoxia, dyspnoea, cyanosis, asphyxia, drowning and periodic breathing. Lung function tests and its clinical significance.

7. Renal Physiology PY 7.1 to 7.9 12 Hours

Structure and functions of kidney. Juxta-glomerular apparatus. Renal blood flow. Role of renin-angiotensin system. Mechanism of urine formation. Concentration and diluting mechanisms. Renal regulation of fluid and electrolytes balance. Acid-base balance. Renal function tests including concept and significance of renal clearance. Structure and innervation of urinary bladder. Physiology of micturition, and its abnormalities. Cystometry and normal cystometrogram. Artificial kidney, Dialysis and Renal transplantation.

8. Endocrine Physiology PY 8.1 to 8.6 15 Hours

Introduction and general principles of endocrinology. Mechanism of action of steroid, protein and amine hormones. Synthesis, secretion, transport, physiological actions, regulation and effect of altered (hypo and hyper) secretion of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas and hypothalamus. Physiology of bone and calcium metabolism. Function tests- thyroid, endocrine pancreas, adrenal cortex and medulla. Minor endocrine glands – thymus, pineal body, heart and kidney.

Obesity and metabolic syndrome. Stress response.

9. Reproductive Physiology PY 9.1 to 9.12 15 Hours

Sex determination, sex differentiation and their abnormalities.

Puberty- onset, progression, stages, early and delayed puberty.

Male Reproductive System: Physiological anatomy. Spermatogenesis and its regulation. Testicular hormones. Semen and its analysis. Cryptorchidism.

Female Reproductive System: Physiological anatomy. Oogenesis. Ovarian hormones. Menstrual cycle- changes in ovary, uterus, cervix, vagina and hormonal regulation. Ovulation and its detection. Fertilization. Implantation. Physiology of pregnancy, Pregnancy tests. Placenta. Fetoplacental unit. Parturition. Lactation. Composition of breast milk.

Contraceptive methods for male and female.

Effects of removal of gonads on physiological functions. Hormonal changes and their

effects during perimenopause and menopause. Causes of infertility and role of IVF in its management. Psychological and psychiatric disturbances associated with reproductive physiology.

10. Neurophysiology PY 10.1 to 10.20 30 + 10 Hours

Nervous System: Organization. Synapse, Receptors and Reflex- types and properties.

Sensory system- Somatic sensations and sensory tracts (including Physiology of pain) and sensory disturbances. Motor system- Motor tracts, mechanism of maintenance of tone, voluntary movements , posture and equilibrium. Spinal cord- functions and lesions. Vestibular apparatus. Reticular activating system. Autonomic nervous system.

Organization, connections and functions of cerebral cortex, basal ganglia, thalamus, hypothalamus, cerebellum and limbic system and their abnormalities.

Physiology of sleep and EEG. Memory, learning and speech and their disorders.

Formation, circulation and functions of CSF. Blood brain barrier. Chemical transmission

Special Senses:

Eye: Functional anatomy of eye. Optics and Image forming mechanisms. Physiology of vision including visual acuity, colour vision, field of vision, refractive errors, light reflexes, accommodation reflex, dark and light adaptations. Visual pathway and its lesions. Visual evoked potentials.

Ear: Functional anatomy of ear and auditory pathways. Physiology of hearing. Deafness and its causes. Hearing tests. Auditory potentials.

Taste and Smell: Modalities, perception and their abnormalities.

11. Integrated Physiology PY 11.1 to 11.12

Temperature regulation- mechanism, adaptation to altered temperature (heat and cold environment), mechanism of fever, cold injuries and heat stroke.

Exercise- cardio-respiratory and metabolic adjustments during exercise (isotonic and isometric), exercise in heat and cold, physical training effects.

Physiological consequences of sedentary lifestyle. Brain death. Physiology of Infancy.* Physiology of aging, free radicals and antioxidants.* Physiology of meditation.*

(* 'Non-core' competencies as per "Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India").

PRACTICALS **180 Hours**

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

I. Procedures to be performed by the students

A. Haematology **50 Hours**

All haematological practicals will be briefed along with clinical case scenarios and students will be trained to interpret the results of the same.

1) Study of Microscope

2) Collection of Blood

3) Study of Fresh drop of blood

4) Effect of Isotonic, Hypertonic and Hypotonic saline on RBC

5) Principles of Haemocytometry

6) RBC count PY2.11

7) WBC count PY2.11

8) Estimation of Haemoglobin PY2.11

9) Determination of RBC indices - MCV, MCH, MCHC and Colour Index PY2.11

10) Differential Leucocyte Count PY2.11

11) Bleeding time and Clotting time PY2.11

12) Blood Grouping PY2.11

B. Procedures to be performed on human subjects **40 Hours**

1) Spirometry - Lung Volumes and Capacities, FEV_1, MVV and Dyspnoeic Index PY6.8

2) Vitalography PY6.8

3) Peak Expiratory Flow Rate (PEFR) by Wright's mini peak flow-meter PY6.10

4) Demonstrate Basic Life Support in a simulated environment [Artificial Respiration and Cardio-pulmonary Resuscitation] PY11.14

5) Recording of Blood Pressure at rest PY5.12

6) Effect of Posture, mild and moderate Exercise on BP PY5.12

7) Harvard step test and its impact on induced physiologic parameters PY3.16

8) Record and interpret Lead II ECG PY5.13

9) Autonomic Function Tests :
   - BP response to isometric exercise by Hand Dynamometer
   - Recording of sinus arrhythmias. PY5.14

10) Mosso's Ergography PY3.14

11) Visual Field by Perimetry PY10.20

C. Clinical Examination **60 Hours**

1) Introduction to the Clinical Examination [history taking and general physical examination] PY11.13

2) Examination of Radial Pulse PY5.12

3) Clinical Examination of Respiratory System PY6.9

4) Clinical Examination of Cardiovascular System PY5.15

5) Clinical Examination of Abdomen PY4.10

6) Examination of Higher mental functions PY10.11

7) Examination of Sensory System PY10.11

8) Examination of Motor System including Reflexes PY10.11

9) Examination of Cranial Nerves PY10.1 & PY10.20

II. Demonstrations **10 Hours**

1) Haematology: Osmotic fragility PY2.12

Erythrocyte sedimentation rate PY2.12

Haematocrit PY2.12

Reticulocyte count PY2.13

Platelet count PY2.13

2) Record Arterial pulse tracing using finger plethysmography* PY5.16

3) Stethography - at rest, effect of deglutition, exercise, voluntary hyperventilation and breaking point after breath holding

4) Tests of cardiovascular autonomic functions* PY5.14(* 'Non-core' competencies as per "Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India")

III. Interpretation of – Charts, Problems, Graphs and Case histories **10 Hours**

Note:- Charts also include - Interpret growth chart*PY11.9, Interpret anthropometric assessment of infants*PY11.10 (*these two charts are 'Non-core' competencies as per "Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India")

IV. Computer assisted learning **10 Hours**

A. Amphibian nerve - muscle experiments and interpretation of graphs

- Simple muscle twitch
- Effect of changes in temperature on simple muscle twitch
- Effect of two successive stimuli on muscle contraction
- Effect of multiple successive stimuli (treppe, clonus, tetanus)
- Study of fatigue in skeletal muscle
- Effect of load on muscle

B. Amphibian cardiac experiments and interpretation of graphs

- Normal cardiogram
- Effect of temperature on frog heart
- Effect of vagus on frog's heart
- Perfusion of isolated heart and effect of ions (NaCl, KCl, $CaCl_2$)
- Perfusion of isolated heart and effect of drugs (adrenaline, acetyl choline)

SKILL CERTIFICATION:

List and number of sessions for skill certification is given below:

	Topics	Number required to certify as per MCI
PY5.12	Record blood pressure & pulse at rest and in different grades of exercise and postures in a volunteer or simulated environment	1 out of 3 times
PY6.9	Demonstrate the correct clinical examination of the respiratory system in a normal volunteer or simulated environment	1 out of 3 times
PY10.11	Demonstrate the correct clinical examination of the nervous system: Higher functions, sensory system, motor system, reflexes, cranial nerves in a normal volunteer or simulated environment	1 each (total 5)
PY10.11 & PY10.20	Demonstrate (i) Testing of visual acuity, colour and field of vision and (ii) Hearing (iii) Testing for smell and (iv) Taste sensation in volunteer / simulated environment	1 each (total 4)

EARLY CLINICAL EXPOSURE: **30 Hours**

Topics	Settings	Department
Myasthenia Gravis	Class room	Medicine
Goitre	Class room	Surgery
Hemiplegia	Class room	Medicine
Hearing defects- Deafness	Hospital	ENT
MI & ECG Recording & findings	Class room	Medicine
Dialysis/ Artificial Kidney	Class room	Medicine
ANC Antenatal care	Hospital	ObG
Paediatric Endocrine disorders- Cushing's syndrome	Class room	Paediatrics
Family planning Methods	Community	ObG
Refractive Errors	Hospital	Ophthalmology

- **Basic science correlations:** Discussion based on case vignettes, graphs, clinical videos, patient in classroom setting, etc. linked to various systems in physiology.

SCHEME OF EXAMINATION

Formative Assessments - Total Marks: 100 (Theory-60 and Practical &Viva-40)

- Three Internal assessments will be conducted.
- Block completion tests ,log book and day to day participation in academic activities will be considered.

Summative Assessment

- Subject shall have Two theory papers of 100 marks each.
- Subject shall have Practicals and viva voce of 100 marks.

SCHEME OF EXAMINATION –FORMATIVE ASSESSMENT -THEORY

THEORY	MARKS	REDUCED TO
I IA	100	50
II IA	100	
III IA(PRELIMINARY EXAM)	200	
PART COMPLETION TESTS (8 TESTS) AND LOG BOOK	100 (80 + 20)	10
FINAL IA MARKS TO BE SENT TO UNIVERSITY		60

SCHEME OF EXAMINATION -FORMATIVE ASSESSMENT-PRACTICAL

PRACTICAL (PRACTICAL + VIVA)	MARKS	REDUCED TO
I IA	50	30
II IA	50	
III IA (PRELIMINARY EXAM)	100	
EARLY CLINICAL EXPOSURE	50	5
SKILL CERTIFICATION	50	5
FINAL IA MARKS TO BE SENT TO UNIVERSITY		40

- Minimum of three internal examinations are conducted
- The preliminary examination preceding the university exam shall be similar to the pattern of university exam
- Best of one of (I IA and II IA) and Preliminary examination will be considered for calculation of final IA
- The total IA marks shall be reduced to 60 Marks separately for theory and 40 Marks for practical and sent to the university as final IA Marks
- Final IA marks will reflect as separate head of passing at the university examination

ELIGIBILITY FOR FINAL EXAMINATION

To be eligible to appear for university examination, a candidate

- Shall have undergone satisfactorily the approved course of study in the subject for the prescribed duration
- Shall have attended minimum 75% of the total number of classes in theory and 80% in practical separately to become eligible to appear for the examination in that subject

- Shall secure 40% of total marks separately assigned for internal assessment in theory and practical in a particular subject
- Shall secure 50% marks in aggregate of the total marks combined in theory and practical assigned for IA in particular subject
- **Instantaneous Examination**
- To be conducted not later than 90 days after the declaration of the results of the final examination

SCHEME OF FINAL UNIVERSITY EXAMINATION

SUBJECT AND DISTRIBUTION OF MARKS

SR NO	THEORY	ANATOMY	PHYSIOLOGY	BIOCHEMISTRY
1	NO OF PAPERS -02	PAPER I PAPER II	PAPER I PAPER II	PAPER I PAPER II
	MAX MARKS	2X100 = 200	2X100 = 200	2X100 = 200
	TOTAL THEORY	**200**	**200**	**200**
2	PRACTICAL	80	80	80
	VIVA VOCE	20	20	20
	TOTAL PRACTICAL	**100**	**100**	**100**
3	INTERNAL ASSESSMENT			
	THEORY	60	60	60
	PRACTICAL AND VIVA VOCE	40	40	40
	TOTAL IA	**100**	**100**	**100**

Final IA marks to be reflected as separate head of passing at the university examination.

TYPE, NUMBER OF QUESTION AND DISTRIBUTION OF MARKS FOR THEORY PAPER

TYPE OF QUESTION	NUMBER OF QUESTION	MARKS FOR EACH QUESTION	TOTAL MARKS
MCQ	20	1	20
LONG ESSAY	2	10	20
SHORT ESSAY	9	5	45
SHORT ANSWER	5	3	15
Total			**100**

UNIVERSITY EXAMINATION

A. Theory: **200 Marks**

There will be two theory papers of 100 marks each and duration of each paper will be of 3 hours. The pattern of questions would be as follows.

PAPER-I*

Distributions of portion for theory papers will be as follows:

Topics	Type & No. of Questions	Marks
All Topics	MCQ 20 X 1	20
General Physiology Blood Cardiovascular System Respiratory System Gastrointestinal System Renal System	Long Essays 2 X 10	20
General Physiology Blood Cardiovascular System Respiratory System Gastrointestinal System Renal System	Short Essays 9 X 5	45
General Physiology Blood Cardiovascular System Respiratory System Gastrointestinal System Renal System (Topic which is not covered in Long Essays can be covered here)	Short Answers 5 X 3	15
	Total	**100**

PAPER-II*

Topics	Type & No. of Questions	Marks
All Topics	MCQ 20 X 1	20
Central Nervous System Special Senses Muscle, Nerve Endocrine Reproductive System	Long Essays 2 X 10	20
Central Nervous system Special Senses Muscle, Nerve Endocrine Reproductive Body Temperature	Short Essays 9 X 5	45
Central Nervous system Special Senses Muscle, Nerve Endocrine Reproductive Skin & Body Temperature (Topic which is not covered in Long Essays can be covered here)	Short Answers 5 X 3	15
	Total	**100**

* A strict division of the topic may not be possible and some overlapping is inevitable. Students should be prepared to answer overlapping topics.

Note: Applied Physiology can be included in both papers.

B. Practical: **80 Marks**

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

Practical I: **40 Marks**

1. Clinical Examination - 20 marks

2. Procedures on Human Subjects - 20 marks

Practical II : **40 Marks**

1. Haematology - Major 20 marks

2 a. Haematology - Minor 10 marks

b. Interpretation of case histories/problems/charts - 10 marks

C. Viva-Voce Examination: **20 Marks**

The Viva- Voce examination will be conducted by 4 examiners individually.

The distribution of topics and marks for each examiner will be as under:

1. General Physiology, Blood, Gastrointestinal System, Renal System - 05 marks
2. Respiratory System, Cardiovascular System - 05 marks
3. Endocrines, Reproduction System (Male and Female) - 05 marks
4. Nerve Muscle Physiology, CNS, Special Senses - 05 marks

Note: Applied Physiology can be asked by all Four examiners in all systems.

Criteria for pass in university examination

- For declaration of pass in any subject in the university examination a candidate shall pass both theory and practical components separately in the same examination as stipulated below
- For a pass in theory examination for each subject a student must secure **minimum 40% of marks in each of the two theory papers** with minimum 50% of marks in aggregate (both papers together)
- For a pass in Practical Examination for each subject a student must secure minimum 50% of marks in aggregate in practical and viva voce examination
- Candidates must secure 50% aggregate in internal assessment examinations (Combined in Theory & Practical) in subject.
- **Internal assessment shall be reflected as a separated head of passing at the final university examination**
- **For a pass in subject, a student shall secure 50% marks in aggregate of the total marks combined in theory, Practical and viva voce**

Recommended Books: (Latest Editions)

Text Books

Sl. No.	Title	Author	Publishers
1.	Text of Medical Physiology	Guyton A. C.	Prism Publishers
2.	Review of Medical Physiology	Ganong W F.	Lange/McGraw Hill Companies
3.	Text book of Medical Physiology	Jain A. K.	Avichal Publishing Company
4.	Comprehensive Text book of Medical Physiology	Pal G. K.	Jaypee Brothers Medical Publishers
5.	Textbook of Medical Physiology	Prof. G.K.Pal	Ahuja Publishers
6.	Textbook of Medical Physiology	Indu Khurana	Elsevier Publishers

Practical Manuals

Sl. No.	Title	Author	Publishers
1.	Manual of Practical Physiology	Jain A. K.	Arya Publications
2.	Practical Physiology	Pravati Pal	Universities Press India Limited
2.	A Textbook of Practical Physiology	Ghai C.L	Jaypee Brothers Medical Publishers
3.	Hutchison's Clinical Methods	Hunter, Bomford	Bailliere Tindal

Reference Books: (Latest Books)

Sl. No.	Title	Author	Publishers
1.	Clinical Physiology	Campbell E. J. M.	ELBS
2.	Physiology	Berne R. M. & Levy M. N.	Mosby Publication
3.	Human Physiology	Schmidt R.F. & Thews G.	Springer Verlog,
4.	Physiology & Biophysics	Patton H. D.	W.B.Sounders
5.	Text of Physiology	Rainer & Nindhaest	Springer verlog

BIOCHEMISTRY

BIOCHEMISTRY

I. GOAL:

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

II. OBJECTIVES:

A) KNOWLEDGE:

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

1) Describe the molecular and functional organization of a cell and list its subcellular components;

2) Delineate structure, function and inter-relationships of biomolecules and consequences of deviation from normal;

3) Summarize the fundamental aspects of enzymology and clinical application wherein regulation of enzymatic activity is altered;

4) Describe digestion and assimilation of nutrients and consequences of malnutrition;

5) Integrate the various aspects of metabolism and their regulatory pathways;

6) Explain the biochemical basis of inherited disorders with their associated sequelae;

7) Describe mechanisms involved in maintenance of body fluid and pH homeostasis;

8) Outline the molecular mechanisms of gene expression and regulation, the principles of genetic engineering and their application in medicine;

9) Summarize the molecular concept of body defences and their application in medicine;

10) Outline the biochemical basis of environmental health hazards, biochemical basis of cancer and carcinogenesis;

11) Familiarize with the principles of various conventional and specialized laboratory investigations and instrumentation analysis and interpretation of a given data;

12) Suggest experiments to support theoretical concepts and clinical diagnosis.

B) SKILLS:

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

1) Make use of conventional techniques / instruments to perform biochemical analysis relevant to clinical screening and diagnosis;

2) Analyze and interpret investigative data;

3) Demonstrate the skills of solving scientific and clinical problems and decision making.

C) INTEGRATION:

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

TEACHING HOURS AND METHODS:

Theory	90 Hours
Non-lecture teaching (small group teaching/tutorials/integrated learning/practical)	141 Hours
Self directed learning	22 Hours
Total	**253 Hours**
Early clinical exposure	30 Hours
Grand total	**265 Hours**

ATTENDANCE

Every candidate must have attendance minimum of 75% of the total classes conducted in theory and practical separately . Each candidate also must have 75% minimum attendance in self directed learning(SDL) , Early clinical exposure (ECE) , small group teaching (SGT) / Tutorial / Integrated teaching and AETCOM in each calendar year calculated from date of commencement of academic session to the last working day as notified by the university in each of the subjects to be eligible to appear for university examination

SUBMISSION OF LOG BOOK & LABORATORY RECORD NOTE BOOK

At the time of Practical Examination each candidate shall submit to the Examiners his/ her log book & laboratory notebook duly certified by the Head of the Department as a bonafide record of the work done by the candidate

COURSE CONTENTS

Topic: Basic Biochemistry **4 Hrs**

BI1.1: Molecular and functional organization of a cell and its subcellular components

- Cell organelles –Biochemical functions
- Cell Membrane - Fluid mosaic model, composition, Fluidity of membrane
- Transport across cell membranes with examples
    - Passive transport – Diffusion and facilitated transport (ion channels)
    - Active transport – Primary and Secondary
    - Endocytosis and Exocytosis
    - Aquaporins

Topic: Enzymes- **13 Hrs**

BI2.1: Fundamental concepts of enzyme, isoenzyme, alloenzyme, coenzyme & co-factors. Main classes of IUBMB nomenclature.

- Enzymes- Definition, General properties, IUBMB Classification.
- Coenzymes and Cofactors
- Enzyme specificity

BI2.3: Basic principles of enzyme activity

- Factors affecting enzyme activity
- Effect of substrate concentration - Michaelis -Menton theory(derivation not required), Km value and its significance
- Mechanism of enzyme action; Substrate strain theory, covalent catalysis, Acid base catalysis, Metal ion catalysis

- Enzyme regulation by- Short term (Covalent modification, Zymogen activation, Allosteric regulation, Feedback regulation) and long term regulation (Induction and repression)

BI2.4: Enzyme inhibitors as poisons and drugs and as therapeutic enzymes

- Enzyme inhibition – Competitive, Non-competitive and Uncompetitive inhibition with examples of clinical importance
- Suicide inhibition
- Enzymes as toxins – Eg. Snake venom phospholipase

BI2.5: Clinical utility of various serum enzymes as markers of pathological conditions— **and** BI2.7: Laboratory results of enzyme activities & Clinical utility of various enzymes as markers of pathological conditions-

Clinical Enzymology – Concept of plasma functional and non-functional enzymes

- Diagnostic Importance of enzymes – LDH, CK, AST, ALT, ALP, GGT, Amylase, Lipase, ACP, 5'nucleotidase
- Isoenzymes – Definition, Diagnostic Importance of isoenzymes with examples.
- Enzymes as Therapeutic agents

BI2.6: Use of enzymes in laboratory investigations (Enzyme-based assays)

- Enzymes used in diagnostic assays as laboratory reagents

Topic: Chemistry and Metabolism of Carbohydrates – 25 Hrs

BI3.1: Monosaccharides, di-saccharides and polysaccharides - examples of main carbohydrates as energy fuel, structural element and storage in the human body

- Carbohydrates: Definition, Biomedical importance, Classification with examples
- Monosaccharide derivatives – Uronic acids, aminosugars, Glycosides, Sorbitol, Mannitol and their Clinical significance.
- Disaccharides, oligosaccharides -composition, importance

- Polysaccharides –Homopolysaccharides – Composition and Importance of starch, glycogen, Dextran, Cellulose and Inulin.
- Heteropolysaccharides – Mucopolysaccharides (Composition and function)
- Concept of glycation and glycosylation
- Importance of Glycoproteins

BI3.2: Digestion and assimilation of carbohydrates and storage **and** BI3.3: Digestion and assimilation of carbohydrates from food.

- Digestion and absorption of carbohydrates
- Lactose intolerance
- Glucose transporters and, Insulin dependent and Insulin independent uptake of glucose by tissues

BI3.4: Pathways of carbohydrate metabolism, (glycolysis, gluconeogenesis, glycogen metabolism, HMP shunt) **and** BI3.5: Regulation, functions and integration of carbohydrate along with associated diseases/disorders.

- Glycolysis- Significance, Site, key steps, energetics, regulation (BI 3.5), inhibitors
- Rapaport Leubering cycle and its significance
- Gluconeogenesis- Significance, Site, key steps, regulation (BI 3.5)
- Cori's cycle
- Glycogenesis, Glycogenolysis- Significance, Site, key steps, regulation (BI 3.5)
- Glycogen storage disorders
- Significance of HMP shunt pathway and uronic acid pathway
- Glucose-6-Phosphate dehydrogenase deficiency
- Galactosemia, Essential Fructosuria, Hereditary fructose intolerance

BI3.6: Concept of TCA cycle as amphibolic pathway and its regulation**.**

- Citric acid cycle, Amphibolic role, Anaplerotic reactions, Regulation and energetics

BI3.7: Common poisons that inhibit crucial enzymes of carbohydrate metabolism (eg; fluoride, arsenate)

- Action of Flouride on Glycolysis
- Action of Arsenate, Malonate and Flouroacetate on TCA cycle

BI3.8: Laboratory results of analytes associated with metabolism of carbohydrates-

Discussion and interpretation of

- Galactosemia
- Hereditary fructose intolerance
- Von Grieke's disease
- Diabetes mellitus
- Poor glycemic control of DM with complication of keto acidosis.
- Chronic Complications of Diabetes mellitus

BI3.9: Mechanism and significance of blood glucose regulation in health and disease **and** BI3.10: Results of blood glucose levels and other laboratory investigations related to disorders of carbohydrate metabolism- Interpretation-

- Regulation of blood glucose levels in well fed condition and fasting/ starvation
- Guidelines for diagnosis of Diabetes mellitus
- Artificial sweeteners- list, use, metabolic effects (briefly) and concerns (to be discussed with in context of their use in Diabetes Mellitus).
- Diabetes mellitus – types, metabolic changes, complications and monitoring of DM patients

Topic: Chemistry and Metabolism of Lipids – 19 Hrs

BI4.1: Main classes of lipids (Essential/non-essential fatty acids, cholesterol and hormonal steroids, triglycerides, major phospholipids and sphingolipids) relevant to human system and their major functions.

- Definition, Modified Bloor's classification with examples.
- Biomedical importance of lipids
- Fatty acids - Definition, examples and importance of Essential fatty acids, Mono and Polyunsaturated fatty acids, n3 and n6 fatty acids, Trans-fatty acids.
- Triacylglycerol – composition and importance
- Phospholipids - Types, functions with clinical importance, Respiratory distress syndrome
- Glycolipids – Types and importance
- Cholesterol - structure and biological importance
- Lipoproteins - Types and functions

BI4.2: Digestion and absorption of dietary lipids and key features of their metabolism-

- Digestion and Absorption of Lipids
- Steatorrhea
- Key features of following Pathways – Significance, Site, key steps, energetics, regulation
    - Beta oxidation
    - Ketogenesis, ketolysis
    - Cholesterol biosynthesis upto mevalonate. Derivatives of Cholesterol
    - Other types of Oxidation of fatty acids and associated disorders

BI4.3: Regulation of lipoprotein metabolism & associated disorders. **and** BI4.4: Structure and functions of lipoproteins, their functions, interrelations & relations with atherosclerosis

- Lipoprotein metabolism- Structure, Composition, Types, Functions and metabolism of Chylomicrons, VLDL, LDL, HDL
- Atherosclerosis – definition, role of lipids in atherogenesis (LDL, Oxidised LDL, Lp(a), Small dense LDL, HDL)
- Hyperlipoproteinemias
- Biochemical basis of use of hypolipidemic drugs
- Fatty liver and lipotropic factors

BI4.5: Laboratory results of analytes associated with metabolism of lipids **and** BI4.7: Laboratory results of analytes associated with metabolism of lipids-

Interpretation of

- Lipid profile, Dyslipidemia
- Lab tests in Myocardial infarction

BI4.6: Therapeutic uses of prostaglandins and inhibitors of eicosanoid synthesis.

- Outline of Prostaglandins and eicosanoid synthesis
- Biological functions of PGs
- Therapeutic uses of prostaglandins and inhibitors of eicosanoid synthesis

Topic: Chemistry and Metabolism of Proteins- **29 Hrs**

BI5.1: Structural organization of proteins-

- Amino acids – Classification based on side chain properties, nutritional requirement and on basis of metabolic fate
- Standard and non-standard amino acids
- Isoelectric pH
- Primary, secondary, super secondary structures/ motifs, domains, tertiary and quaternary structures

- Bonds stabilizing protein structure

BI5.2: Functions of proteins and structure-function relationships in relevant areas eg, hemoglobin and selected hemoglobinopathies

- Proteins – Definition, Classification based on functions and nutritional value
- Denaturation - definition, causes, properties of a denatured protein, significance.
- Structure function relationship of proteins - haemoglobin, myoglobin, collagen and Insulin

BI5.3: Digestion and absorption of dietary proteins**.**

- Digestion and absorption, and associated disorders

BI5.4: Common disorders associated with protein metabolism**.**

- General reactions – Transamination, Transmethylation, Transdeamination, Deamination - Oxidative and nonoxidative and their significance.
- Biogenic amines
- Sources and fate of ammonia - Trapping, Transport and Disposal of ammonia, ammonia toxicity. Urea cycle and its disorders
- Amino acid metabolism
    - Glycine – specialised products and their importance
    - Phenylalanine, Tyrosine – metabolic pathway, synthesis of catecholamines, other specialised products formed from tyrosine and their importance. Phenylketonuria, Albinism, Alkaptonuria, Tyrosinemia, Pheochromocytoma
    - Tryptophan- synthesis of serotonin and melatonin and their importance. Hartnup's disease, Carcinoid syndrome
    - Sulphur containing amino acids – functions of cysteine and methionine. Synthesis and Functions of SAM, SAH. Homocysteine and Homocysteinemia

- Formation of Nitric oxide and its importance

- Important functions/products from histidine, serine, Aspartate, Asparagine, glutamate, glutamine, serine, branched chain amino acids. Maple Syrup Urine Disease, Aminoaciduria

BI5.5: Laboratory results of analytes associated with metabolism of proteins-Interpretation **and** BI11.5 Describe screening of urine for inborn errors & describe the use of paper chromatography

- Newborn screening tests- Interpretation of laboratory reports of Inborn errors of metabolism

- Inborn errors of metabolism – enzyme defects, clinical features, laboratory diagnosis and biochemical basis of management of – PKU, Tyrosinosis, Alkaptonuria, Albinism, Homocystinuria, Maple syrup urine disease (MSUD)

Topic: Metabolism and homeostasis – 53 Hrs

BI6.1: Metabolic processes that take place in specific organs in the body in the fed and fasting states**.**

- Metabolic processes taking place in specific organs in the body in fed, fasting and exercise states. Biochemical changes during starvation

- Adipose tissue – Hormones secreted from adipose tissue (adipokines – leptin, adiponectin) their functions and role in hunger and satiety.

BI6.2: Metabolic processes in which nucleotides are involved-

- Sources of atoms of Purine and Pyrimidine ring and outline of de novo synthesis of purines and pyrimidines

- Salvage pathway of purine biosynthesis and Significance

- Purine analogues used as anticancer drugs

BI6.3: Common disorders associated with nucleotide metabolism and BI6.4: Laboratory results of analytes associated with gout & Lesch Nyhan syndrome

- Catabolism of Purines. Uric acid -importance

- Etiology, manifestations and biochemical basis of clinical manifestations of – Gout, LeschNyhan syndrome
- Diagnostic importance of Adenosine deaminase
- Severe Combined Immunodeficiency Disorder (SCID) and Oroticaciduria

BI6.5: Biochemical role of vitamins in the body and manifestations of their deficiency

- Fat soluble vitamins (A, D, E, K)- RDA, Sources, Absorption, Storage, Biochemical functions, Deficiency manifestations and hypervitaminosis.
- Water soluble vitamins (Vitamin C, Folic acid, Vitamin B12, Thiamine, Riboflavin, Niacin, Pyridoxine, Biotin, Pantothenic acid)- RDA, Sources, Biochemical functions, Deficiency manifestations
- Antivitamins

BI6.6: Biochemical processes involved in generation of energy in cells.

- High Energy Compounds – Definition and Biological significance.
- Transport of reducing equivalents across mitochondria
- Electron Transport Chain – Organization, components, flow of electrons.
- Oxidative Phosphorylation – Sites, mechanism (Chemiosmotic theory).
- Inhibitors of Electron Transport Chain and oxidative phosphorylation. Uncouplers and their significance.

BI6.7: Processes involved in maintenance of normal pH, water & electrolyte balance of body fluids and the derangements associated with these.

- Distribution of water and electrolytes in ICF and ECF
- Regulation of water and electrolyte balance
- Disorders of electrolyte imbalance – causes and clinical features of Hyperkalemia, Hypokalemia, Hypernatremia, Hyponatremia
- Dehydration

BI6.8: Results of Arterial Blood Gas (ABG) analysis in various disorders- Interpretation

- Regulation of pH of blood by buffers, respiratory and renal mechanisms
- Anion gap and its significance
- Acidosis and alkalosis (metabolic and respiratory) – causes, compensatory mechanisms and lab findings

BI6.9: Functions of various minerals in the body, their metabolism and homeostasis **and** BI6.10: Disorders associated with mineral metabolism.

- Major elements and trace elements
- Sources, RDA, absorption and transport, Homeostasis, Functions, Biological reference range, disorders associated with – Calcium, phosphorus, Iron
- Sources, RDA, Functions and disorders associated with - Copper, Zinc, Selenium, Fluoride, Iodine, Magnesium, Molybdenum.

BI6.11: Functions of haem in the body and processes involved in its metabolism. Porphyrin metabolism**.**

- Heme – Outline of Synthesis, porphyrias
- Degradation of Heme, Bilirubin metabolism – synthesis, transport, conjugation, excretion
- Jaundice – definition, types, causes, lab diagnosis, congenital hyperbilirubinemias

BI6.12: Major types of haemoglobin and its derivatives found in the body and their physiological/ pathological relevance.

- Hemoglobin – Adult, fetal and embryonic types
- Abnormal hemoglobins– carboxy, sulph, metHb.
- Hemoglobinopathies – molecular defects, pathophysiological changes in thalassemias and sickle cell anemia

BI6.13: Functions of the kidney, liver, thyroid and adrenal glands **and BI6.14**: Tests that are commonly done in clinical practice to assess the functions of these organs

(kidney, liver, thyroid and adrenal glands). **and BI6.15:** Abnormalities of kidney, liver, thyroid and adrenal glands **and BI11.17**: Explain the basis and rationale of biochemical tests done in the following conditions: Diabetes mellitus, Dyslipidemia, Myocardial infarction, Renal failure, Gout, Proteinuria, Nephrotic syndrome, Edema, Jaundice, Liver diseases, Pancreatitis, Disorders of acid- base balance, Thyroid disorders and BI11.3 Describe the chemical components of normal urine and BI11.4 Urine analysis to estimate and determine normal and abnormal constituents

- Functions of Liver, Kidney, Thyroid and adrenals.
- Liver Function Tests: Tests based on Synthetic, Excretory, and Role of enzymes in hepatic dysfunction
- Renal Function tests – Tests to assess glomerular and tubular functions
- Thyroid function tests
- Adrenal function tests
- Mechanism of action of Group I and Group II hormones

Topic: Molecular biology – **24 Hrs**

BI7.1: Structure and functions of DNA and RNA. Outline of cell cycle**.**

- Nitrogenous bases: Purines and Pyrimidines (Major, Minor, Free Bases)
- Nucleosides and Nucleotides – Structure, examples, Importance
- Nucleoside derivatives: NMP, NDP, NTP cAMP, SAM, PAPS, UDP sugars etc
- Synthetic Nucleotide Analogues and their application
- Structure and function of DNA (B-DNA)
- Structural organization of DNA to form chromatin (Primary and Secondary)
- Types of RNA (hnRNA, mRNA, rRNA, tRNA, snRNA) with structure and functions
- microRNA (miRNA) and small interfering RNA (siRNA) and their applications in medicine
- Cell cycle- Phases and significance.

BI7.2: Replication & repair of DNA. Transcription & translation mechanisms.

- DNA replication - prokaryotic and eukaryotic replication, requirements, process, inhibitors, Telomere, Telomerase and its importance
- DNA repair mechanisms. Diseases associated with DNA repair
- Transcription process- Transcriptional units, promoter regions, RNA polymerases in prokaryotes and eukaryotes, Differences between prokaryotic and Eukaryotic transcription and Inhibitors of transcription process. Post transcriptional modifications of mRNA
- Genetic Code and its characteristics
- Protein Biosynthesis: Requirements and activation of amino acids, Translation in Eukaryotes, Inhibitors of Translation. Post translational modifications

BI7.3: Gene mutations. Basic mechanism of regulation of gene expression.

- Mutations, causes, types of mutation, Consequences with examples
- Regulation of Gene expression: Gene, introns, exons, cistron
- Regulation of gene expression in prokaryotes with illustration of Lac Operon
- Regulation of gene expression in eukaryotes – Role of enhancers, repressors, DNA regulatory elements, gene amplification, gene rearrangement, RNA processing, RNA editing, mRNA stability.

BI7.4: Applications of molecular technologies like recombinant DNA technology, PCR in the diagnosis and treatment of diseases with genetic basis**.**

- Recombinant DNA technology, DNA cloning - process and application
- PCR technique and its application
- Blotting techniques
- Concept, types and application of gene therapy.
- DNA Polymorphism, SNP, VNTR, RFLP
- DNA genomic and cDNA libraries
- DNA Probes

- DNA Microarrays
- Overview of Human Genome Project HGP

BI7.5: Role of xenobiotics in disease

- Xenobiotics and disease caused.
- Biotransformation
- Phase –I reactions and Phase-II reactions: Oxidation, Hydroxylation, reduction, hydrolysis, Acetylation, Methylation, and Conjugation reactions-Glucuronic acid, Glutathione, Glycine
- Cytochrome P450

BI7.6: Anti-oxidant defence systems in the body. **and** BI7.7: Role of oxidative stress in the pathogenesis of conditions such as cancer, complications of diabetes mellitus and atherosclerosis.

- Free radicals, Reactive oxygen species (ROS), Reactive nitrogen species (RNS)
- Damaging effects of ROS on biomolecules, lipid peroxidation
- Anti-oxidant defence system of our body – enzymes, vitamins, metabolites as antioxidants
- Role of oxidative stress in atherosclerosis, diabetes mellitus and cancer

Topic: Nutrition- **12 Hrs**

BI8.1: Importance of various dietary components and dietary fibre **and** BI8.6: Nutritional importance of commonly used items of food including fruits and vegetables. (macro-molecules & its importance) and BI11.24 Enumerate advantages and/or disadvantages of use of unsaturated, saturated and trans fats in food

- Balanced diet – definition, composition
- Dietary fibres – definition, examples, importance
- Glycemic index – definition, calculation, importance
- Nutritional importance of Carbohydrates, Lipids, Proteins, Vitamins and minerals, commonly used food items including fruits and vegetables

BI8.2: Types and causes of protein energy malnutrition and its effects

- Types, causes and effects of Protein energy malnutrition

BI8.3: Dietary advice for optimal health in childhood and adult, in disease conditions like diabetes mellitus, coronary artery disease and in pregnancy.

- BMR – Definition, Normal values, Factors affecting and biomedical importance
- SDA – Definition and significance (Thermogenic effect of food)
- Nitrogen balance.
- Nutritional indices
- Calculation of calorie requirement
- Dietary advice for optimal health in childhood and adults, special conditions like diabetes, coronary artery disease, pregnancy.

BI8.4: Causes (including dietary habits), effects and health risks associated with being overweight/ obesity**.**

- Obesity – Definition, BMI, types, causes, role of GI peptides and adipokines in obesity, associated health risks (e.g., metabolic syndrome)

BI8.5: Nutritional importance of commonly used items of food including fruits and vegetables. (Macro-molecules & its importance)

- Nutritional content and importance of commonly used food items(Cereals, Pulses, Milk and Dairy, Meat poultry and fish, Fruits and vegetables)

BI11.23 Calculate energy content of different food Items, identify food items with high and low glycemic index and explain the importance of these in the diet

- Calculate the energy content of food items

Topic: Extracellular Matrix- **4 Hrs**

BI9.1: Functions and components of the extracellular matrix (ECM) and BI9.2: ECM components in health and disease and BI9.3: Protein targeting & sorting. Associated disorders.

- Composition of ECM – Proteins: Composition and functions of Collagen, elastin, fibrillin, fibronectin, laminin and Proteoglycans.

- Involvement of ECM components in health and disease. E.g. Osteogenesis Imperfecta, Ehler-Danlos syndrome, Scurvy, Alpha anti trypsin deficiency.

Topic: Oncogenesis and immunity- **6 Hrs**

BI10.1: Cancer initiation, promotion, oncogenes & oncogene activation. p53 & apoptosis **and** BI10.2: Biochemical tumor markers and the biochemical basis of cancer therapy.

- Cell cycle, regulation, abnormal cell growth, programmed cell death (apoptosis)
- Cell signalling (action of hormones and growth factors) – Cell surface receptors - G protein coupled signaling, catalytic receptor signaling, steroid receptor signaling
- Mutagens and carcinogens: Definitions, examples and their actions in carcinogenesis
- Proto oncogenes and their activation, oncogenes, tumour suppressor genes and their role in development of cancer
- Oncogenic viruses (HPV and cervical cancer)
- Growth factors and their receptors
- Tumour markers and their importance in diagnosis and prognosis of cancer
- Biochemical basis of cancer therapy – alkylating agents, antimetabolites, topoisomerase inhibitors, antibiotics, hormones, receptor blockers, radiotherapy etc
- Monoclonal antibodies and their application

BI10.3: Cellular and humoral components of the immune system. Types and structure of antibody **and** BI10.4: Innate and adaptive immune responses, self/non-self-recognition and the central role of T-helper cells in immune responses **and** BI10.5: Antigens and concepts involved in vaccine development.

- Cellular and humoral components of immune system
- Immunoglobulins – Classes, structure function relationship
- Innate and adaptive immune responses, self/non-self-recognition

- Role of T-helper cells in immune responses
- Ig class switching
- Concept of Immune tolerance and Autoimmunity
- Antigens and concepts in vaccine development – types of vaccines, immunological basis of vaccine development, recombinant DNA technology in vaccine development.

Topic: Biochemical Laboratory Tests **76 Hrs**

BI11.1 Commonly used laboratory apparatus and equipments, good safe laboratory practice and waste disposal and BI11.19 Outline the basic principles involved in the functioning of instruments commonly used in a biochemistry laboratory and their applications

Small group discussion, lab visit

- Lab safety and Biomedical waste disposal, Commonly used lab equipment, glassware and reagents

BI11.2, 11.16, 11.19 Describe the preparation of buffers and estimation of pH.

Demonstration -Observe

- Preparation of buffers and estimation of pH using pH meter

BI11.4 and BI11.20 Urine analysis to estimate and determine normal and abnormal constituents and BI11.20 Identify abnormal constituents in urine, interpret the findings and correlate these with pathological states.

Qualitative analysis- DOAP sessions

- Examine Physical properties, Inorganic constituents (Calcium, Phosphorus and Ammonia) and Organic constituents (Urobilinogen, Urea, Uric acid and Creatinine)
- Chemical tests for Glucose, Ketone Bodies, Blood, Proteins, Bile salts and Bile Pigments
- Demonstration by using Dip sticks

BI11.6 and BI11.18: Describe the principles of colorimetry

Demonstration - Observe

- Colorimetry and Spectrophotometry

BI11.9 Demonstrate the estimation of serum total cholesterol and HDL- cholesterol

Demonstration and Interpretation

- Estimation of Total cholesterol and High density lipoprotein(HDL) cholesterol

BI11.10 Demonstrate the estimation of triglycerides

Demonstration and Interpretation

- Estimation of Triglycerides

BI11.11 Demonstrate estimation of calcium and phosphorous

Demonstration and Interpretation

- Estimation of Calcium and Phosphorous

BI11.12 Demonstrate the estimation of serum bilirubin

Demonstration and Interpretation

- Estimation of Serum Bilirubin

BI11.13 Demonstrate the estimation of SGOT/ SGPT and BI2.2: Observe the estimation of SGOT & SGPT

Demonstration and Interpretation

- Estimation of AST(SGOT), ALT(SGPT) activity

BI11.14 Demonstrate the estimation of alkaline phosphatase

Demonstration and Interpretation

- Estimation of ALP activity

BI11.15 Describe & discuss the composition of CSF

Demonstration and Interpretation

- Analysis of CSF

BI11.16, BI11.5, BI5.5, and BI11.19 Observe use of commonly used equipments/ techniques in biochemistry laboratory including: pH meter/ABG/ISE-Paper chromatography of amino acid, Protein electrophoresis**,** TLC, PAGE, Electrolyte analysis by ISE, ABG analyser, ELISA**,** Immunodiffusion

Small Group discussion and biochemistry lab visit

- Basic concepts of clinical chemistry laboratory, Clinical chemistry autoanalyser (Automation – advantages) and quality control (Internal and External quality control, Precision, Accuracy, QC rules), Biological reference intervals

Lab visit and lab collection centre

- Specimen collection and preanalytical errors in clinical Biochemistry:

Small Group Discussion and demonstration

- Serum protein electrophoresis, types and applications
    - Functions and clinical significance of plasma proteins - Albumin, alpha, beta and gamma.
    - Acute phase reactants - Positive and Negative (clinical significance)
    - Biological Reference range of serum total protein, albumin, total globulin, C reactive protein
    - Multiple Myeloma
    - Separation and identification of plasma proteins by electrophoresis

Demonstration and Interpretation

- Paper chromatography/TLC of amino acids/sugars, types and applications
- Estimation of serum electrolytes by ISE

- Blood gas analysis using ABG analyser
- Principle, procedure and applications of ELISA, protein extraction, Blotting techniques, PAGE

Small Group Discussion, Demonstration and Interpretation

- Principle, procedure and applications of PCR, DNA isolation

BI11.21 Demonstrate estimation of glucose, creatinine, urea and total protein in serum. **and** BI11.7 Demonstrate the estimation of serum creatinine and creatinine clearance **and** BI11.8 Demonstrate estimation of serum proteins, albumin and A:G ratio **and** BI11.22 Calculate albumin: globulin (AG) ratio and creatinine clearance

DOAP sessions – Perform(Skill) and Interpret

- Estimation of plasma glucose by Enzymatic method and Glucometer as point of care testing BI3.10
- Estimation of serum and urine creatinine by Jaffe's method, Creatinine Clearance
- Estimation of blood urea by Urease/ GLDH method
- Estimation of Total Protein and Albumin in serum by Biuret and BCG method, A:G ratio

CERTIFICATION OF SKILL

SL NO	Skill with Competency Number	Competent	Date	Signature
1	BI 11.4 Perform urine analysis to estimate and determine normal constituents	Y/N		
2	BI 11.4 Perform urine analysis to estimate and determine abnormal constituents	Y/N		
3	BI 11.20 Identify abnormal constituents in urine, interpret the findings and correlate these with pathological states.	Y/N		
4	BI 11.7 Estimation of serum creatinine and creatinine clearance	Y/N		
5	BI 11.8 Estimation of serum proteins, albumin and A:G ratio	Y/N		
6	BI 11.21 Estimation of glucose and Demonstrate the use of glucometer	Y/N		
7	BI 11.21 Estimation of urea	Y/N		

Early Clinical Exposure

Sl No	Topic
1.	Vitamin A deficiency
2.	Vitamin D deficiency-
3.	AITO- DM-Diabetes Mellitus
4.	Dyslipidemia
5.	Thyroid Disorders
6.	GOUT
7.	Jaundice
8.	IEM(Inborn Errors of Metabolism)
9.	Nephrotic Syndrome
10.	Protein Energy Malnutrition

LOG BOOK: Every student shall maintain a logbook and record his/her participation in the academic activities conducted by the department.

Scheme of Examination

University Examination: Theory- 200 marks (2 papers of 100 marks each)

	Topics	Type of Questions	Marks distribution
Theory Paper I	• Molecular and functional organization of a cell and its subcellular components • Enzymes • Chemistry & Metabolism of Carbohydrates • Chemistry and Metabolism of Lipids • Chemistry and Metabolism of Proteins • Nutrition	MCQ Long Essay Short Essay Short Answers	MCQs 20 x 1 = 20 LEQ 2x 10 = 20 SEQ 5x 9 = 45 SAQ 5x3 = 15
Theory Paper II	• Metabolism and Homeostasis • Molecular Biology • Extracellular Matrix • Oncogenesis and Immunity	MCQ Long Essay Short Essay Short Answers	MCQs 20 x 1 = 20 LEQ 2x 10 = 20 SEQ 5x 9 = 45 SAQ 5x3 = 15

University Examination: Practical 80 marks + Viva Voce 20 marks- Total 100 marks

Practical- 80 marks (4 exercises)	**Exercises**	**Marks**
Objective Structured Practical Examination (OSPE):	3 stations (one performance station carrying 10 marks and 2 interpretation stations each carrying 5 marks)	20 marks
Qualitative analysis:	Urine analysis to estimate and determine normal and abnormal constituents	20 marks
Quantitative analysis:	Performance of any one of the following •Estimation of plasma glucose by Enzymatic method •Estimation of serum and urine creatinine by Jaffe's method and Creatinine Clearance •Estimation of blood urea by Urease/ GLDH method •Estimation of Total Protein and Albumin in serum by Biuret and BCG method and A:G ratio	20 marks
Case report Interpretation:	Interpretation of case reports related to • Lab safety and Biomedical waste disposal, Commonly used lab equipment, glassware and reagents • Liver Functions tests, Kidney Function tests and adrenal gland Function tests • Diabetes Mellitus, Dyslipidemia, Myocardial infarction, Renal failure, Gout, Proteinuria, Nephrotic syndrome, Edema, Jaundice, Liver diseases, Pancreatitis, Disorders of acid- base balance, Thyroid disorders	20 marks
Sub-Total		**80 Marks**
Viva-Voce		**20 marks**
Grand Total		**100 marks**

Distribution of topics for VIVA VOCE

Topic I:

- Molecular and functional organization of a cell and its subcellular components
- Enzymes
- Chemistry & Metabolism of Carbohydrates

Topic II:

- Chemistry and Metabolism of Lipids
- Chemistry and Metabolism of Proteins
- Nutrition

Topic III:

- Metabolism and Homeostasis
- Extracellular Matrix

Topic IV:

- Molecular Biology
- Oncogenesis and Immunity
- **Formative Assessments** -3 Internal assessment

  Block completion tests ,log book and day to day participation in academic activities
- **Summative Assessment** following points should be considered.
  - Each subject shall have Two theory papers of 100 marks each
  - Each subject shall have Practicals and viva voce of 100 marks

SCHEME OF EXAMINATION –FORMATIVE ASSESSMENT -THEORY

THEORY	MARKS	REDUCED TO
I IA	100	50
II IA	100	
III I A(PRELIMINARY EXAM)	200	
PART COMPLETION TEST (8 TEST) AND LOG BOOK	100 (80 + 20)	10
FINAL I A MARKS TO BE SENT TO UNIVERSITY		60

SCHEME OF EXAMINATION- FORMATIVE ASSESSMENT –PRACTICAL

PRACTICAL (PRACTICAL + VIVA)	MARKS	REDUCED TO
I IA	50	30
II IA	50	
III I A (PRELIMINARY EXAM)	100	
EARLY CLINICAL EXPOSURE	50	5
SKILL CERTIFICATION	50	5
FINAL I A MARKS TO BE SENT TO UNIVERSITY		40

- Minimum of three internal examination are conducted
- The preliminary examination preceding the university exam shall be similar to the pattern of university exam
- Best of one of (I IA and II IA) and Preliminary examination will be considered for calculation of final I A

- The total I A marks shall be reduced to 60 marks separately for theory and 40 Marks for practical and sent to the university as final I A Marks
- Final I A marks will reflect as separate head of passing at the university examination

SCHEME OF FINAL UNIVERSITY EXAMINATION
SUBJECT AND DISTRIBUTION OF MARKS

SR NO	THEORY	ANATOMY	PHYSIOLOGY	BIOCHEMISTRY
1	NO OF PAPERS -02	PAPER I PAPER II	PAPER I PAPER II	PAPER I PAPER II
	MAX MARKS	2X100 = 200	2X100 = 200	2X100 = 200
	TOTAL THEORY	**200**	**200**	**200**
2	PRACTICAL	80	80	80
	VIVA VOCE	20	20	20
	TOTAL PRACTICAL	**100**	**100**	**100**
3	INTERNAL ASSESSMENT			
	THEORY	60	60	60
	PRACTICAL AND VIVA VOCE	40	40	40
	TOTAL I A	**100**	**100**	**100**

TYPE , NUMBER OF QUESTION AND DISTRIBUTION OF MARKS FOR THEORY PAPER

TYPE OF QUESTION	NUMBER OF QUESTION	MARKS FOR EACH QUESTION	TOTAL MARKS
MCQ	20	1	20
LONG ESSAY	2	10	20
SHORT ESSAY	9	5	45
SHORT ANSWER	5	3	15
Total			**100**

ELIGIBILITY FOR FINAL EXAMINATION

To be eligible to appear for university examination a candidate

- Shall have undergone satisfactorily the approved course of study in the subject for the prescribed duration
- Shall have attended minimum 75% of the total number of classes in theory and practical separately to become eligible to appear for the examination in that subject
- Shall secure 40% of total marks separately assigned for internal assessment in theory and practical in a particular subject
- Shall secure 50% marks in aggregate of the total marks combined in theory and practical assigned for I A in particular subject
- **Instantaneous Examination**
- To be conducted not later than 90 days after the declaration of the results of the final examination

CRITERIA FOR PASS IN UNIVERSITY EXAMINATION

- For declaration of pass in any subject in the university examination a candidate shall pass both theory and practical components separately in the same examination as stipulated below
- For a pass in theory examination for each subject a student must secure **minimum 40% of marks in each of the two theory papers** with minimum 50% of marks in aggregate (both papers together)
- For a pass in Practical Examination for each subject a student must secure minimum 50% of marks in aggregate in practical and viva voce examination
- Candidates must secure 50% aggregate in internal assessment examinations (Combined in Theory & Practical) in subject.
- **Internal assessment shall be reflected as a separated head of passing at the final university examination**
- **For a pass in subject, a student shall secure 50% marks in aggregate of the total marks combined in theory, Practical and viva voce**

Every candidate must have attendance minimum of 75% of the total classes conducted in theory and 80% in practical separately . Each candidate also must have 75% minimum attendance in self directed learning(SDL) , Early clinical exposure (ECE) , small group teaching (SGT) / Tutorial / Integrated teaching and AETCOM in each calendar year calculated from date of commencement of academic session to the last working day as notified by the university in each of the subjects to be eligible to appear for university examination

RECOMMENDED BOOKS

TEXT BOOKS: (Recent editions)

RECOMMENDED BOOKS

TEXT BOOKS: (Recent editions)

1. DM Vasudevan. Textbook of Biochemistry for Medical students
2. Lippincott Illustrated Reviews – Biochemistry- Denise Ferrier -
3. Dinesh Puri. Textbook of Biochemistry

4. Pankaja Naik. Biochemistry

5.. Namrata Chhabra. Case oriented approach towards Biochemistry

6. Biochemistry by Satyanarayana

7. T.N. Pattabhiraman. Laboratory manual and Practical Biochemistry, 4th edition

REFERENCE BOOKS: (Recent editions)

1. Harpers' Illustrated Biochemistry

2. Marshall and Bangert. Clinical Chemistry

3. Baynes and Dominiczak. Medical Biochemistry

4. Bhagavan and Ha. Essentials of Medical Biochemistry with clinical cases

5. Stryer. Biochemistry

COMMUNITY MEDICINE

COMMUNITY MEDICINE

The overall aim of teaching by the Department of Community Medicine is directed towards preparing medical student to function as a Community and Primary Care Physician.

I. Goals:

1. To produce doctors who are well aware of the physical, social, psychological, economic and environmental aspect of health and disease.
2. To enable the student to apply the clinical skills to recognize and manage common health problems including their physical, emotional and social aspects at the individual, family and community levels and deal with public health emergencies.
3. To make the student realize the role of doctor as a team leader.

II. Objectives:

To achieve this he/she will be able to:

a. Organize elementary epidemiological studies to assess the health problems in the area.

b. Prioritise the most important problems and help formulate a plan of action to manage them under National Health Programme guidelines including population control and family welfare program (He/She should be able to assess and allocate resources, implement and evaluate the programmes).

c. Demonstrate knowledge of principles of organizing prevention and control of communicable and non-communicable diseases.

d. Organize health care service for special groups like mother, infants, under five children and school children, handicapped, adolescents and geriatrics, rural, tribal and urban slum dwellers.

e. Organize health care in case of calamities.

f. Inculcate values like compassion, empathy, honesty, sincerity and integrity to ensure high quality ethical professional practice.

g. Work as an effective leader of the health team within the primary health care set-up.

h. Coordinate with and supervise other members of the health team and maintain liason with various agencies (Government, non-government and voluntary organizations).

i. Plan and implement health education programmes.

j. Perform administrative functions of health centres.

k. Promote community participation especially in areas of disease control, health education and implementation of national programmes.

l. Be aware of national priorities and the goal to be achieved to implement primary health care including health for all.

m. Understand different types of Bio-medical waste, their potential risks and their management.

PHASE I: I & II TERM

1. Introduction to Community Medicine **10 Hours**

a) Evolution of Public Health

b) Concepts of health

c) Health indices

d) Health profile of India

e) Medical Ethics

2. Social Medicine **18 Hours**

a) Introduction to Medical Sociology

b) Meaning with definition and scope of medical sociology

c) Basic concepts of sociology: Society, Community, Association, Institution, etc.

d) The study of family – Types and functions

e) Rural community - Characteristics & health problems

f) Urban Community - Characteristics & health problems

g) Social factors in health and disease

h) Cultural factors in health and disease

i) Medico - social worker

j) Leadership in health

3. Fundamentals of Bio-statistics **16 Hours**

a) Introduction to basic statistics

b) Data - Types, Collection and Presentation

c) Simple statistical methods for the analysis of data

d) Frequency distribution

e) Measures of central tendency

f) Measures of variability

4. Demography & Vital statistics **6 Hours**

a) Definition of demography and demographic cycle

b) Concept of demographic gap and population explosion

c) Definition, calculation and interpretation of demographic indices - crude birth rate, crude death rate, fertility rates, etc.

5. Field visits to field practice area **10 Hours**

Clinico-social evaluation of the family

5.1) Study of family composition and socio-economic status, attitude towards health, disease and health services.

5.2) Study of environmental factors influencing health status of the family – housing, water and sanitation.

5.3) Study of morbidity, vital events and assessment of barriers to good health.

TOTAL = 50 hours LECTURE + 10 hours FIELD VISITS = 60 hours

MEDICAL ETHICS

1. PREAMBLE:

Medical ethics is a systematic effort to work within the ethos of medicine, which has traditionally been service to sick. There is now a shift from the traditional individual patient doctor relationship and medical care. With the advances in science and technology and the needs of patient, their families and the community, there is an increased concern with the health of society. There is shift to greater accountability to the society. Doctors and health professionals are confronted with many ethical problems in day to day practice & research. It is therefore necessary to be prepared to deal with these problems.

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

II. OBJECTIVES:

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

1) Identify underlying ethical issues and problems in medical practice and research,

2) Consider the alternatives under the given circumstances, and

3) Make decisions based on acceptable moral concepts and also traditional practices.

COURSE CONTENTS:

I. Introduction to Medical Ethics

What is Ethics ?

What are values and norms ?

Relationship between being ethical and human fulfillment.

How to form a value system in one's personal and professional life ?

Heteronomous Ethics and Autonomous Ethics.

Freedom and personal responsibility.

II. Definition of Medical Ethics

Difference between medical ethics and bio-ethics.

Major Principles of Medical Ethics

Beneficence	=	fraternity
Justice	=	equality
Self determination (autonomy)	=	liberty

III. Perspective of Medical Ethics

The Hippocratic oath

The Declaration of Helsinki

The WHO Declaration of Geneva

International code of Medical Ethics (1993)

Medical Council of India Code of Ethics (2002)

IV. Ethics of the Individual

The patient as a person

The Right to be respected

Truth and Confidentiality

The autonomy of decision

The concept of disease, health and healing

The Right to health

Ethics of Behaviour modification

The Physician - Patient relationship

Organ donation

V. The Ethics of Human life

What is human life?

Criteria for distinguishing the human and the non-human

Reasons for respecting human life

The beginning of human life

Conception, contraception

Abortion

Prenatal sex-determination

In vitro fertilization (IVF), Artificial Insemination by Husband (AIH)

Artificial Insemination by Donor (AID),

Surrogate motherhood, Semen Intrafallopian Transfer (SIFT),

Gamete Intrafallopian Transfer (GIFT),

Genetic Engineering

VI. The Family and Society in Medical Ethics

The Ethics of human sexuality

Family Planning perspectives

Prolongation of life

VII. Death and Dying

Use of life-support systems

Death awareness

The moment of death

Prolongation of life

Ordinary and extraordinary life support

Advanced life directives - The Living Will

Euthanasia - passive and active, Euthanasia Cancer and Terminal Care

Suicide - the ethical outlook

The right to die with dignity

VIII. Professional Ethics

Code of conduct

Contract and confidentiality

Charging of fees, Fee-splitting

Prescription of drugs

Over-investigating the patient

Low-cost drugs, vitamins and tonics

Allocation of resources in health care

Malpractice and Negligence

IX. Research in Ethics

Animal and experimental research/ humanness

Human experimentation

Human volunteer research - Informed Consent

Drug trials

X. Ethical workshop of cases

Gathering all scientific factors

Gathering all human factors

Gathering all value factors

Identifying areas of value - Conflict, Setting of priorities

Working our criteria towards decisions

Teaching / Learning Experience

Classroom teaching would focus on professional relationship, patient-doctor relationship, issues at the beginning and end of life, reproductive technologies, resource allocation and health policy. It will also deal with values, ethical-concepts and principles.

Clinical ethics must be taught as part of bedside teaching, group discussion, case studies, problem analyzing and problem solving exercises may also be employed.

Demonstrating by example, how to identify and resolve a particular problem.

Increasing the awareness and knowledge of students on the value dimensions of interactions with the patients, colleagues, relations and public.

Fostering the development of skills of analysis, decision-making and judgement.

Making the students aware of the need to respect the rights of the patient as also duties and responsibilities of the doctor.

Evaluation

At least one short answer question may be asked on medical ethics appropriate to the subjects in the University question paper. A few questions may be asked during viva voce examination, appropriate to the subject.

Recommended distribution of Teaching hours in different phases of MBBS Course **Total Teaching Hours: 40**
Phase I: Pre-clinical Period – 6 hours 2 hours each by Anatomy, Physiology and Biochemistry during the 1st year. Phase II: Para-clinical Period – 6 hours 2 hours each by Pharmacology, Pathology and Microbiology. Phase III: Community Medicine – 4 hours 2 hours each from Ophthalmology and ENT – 4 hours 2 hours each in two terms from Medicine, Surgery and OBG – 12 hours 8 hours from other clinical departments.
N.B.: The teaching of Medical Jurisprudence by the Department of Forensic Medicine will continue.

Recommended Books: (Latest Edition)

1) Medical Ethics by Francis C. M.

2) Ethical Guidelines for Biomedical Research on Human Subjects, Indian Council of Medical Research, New Delhi.

LAW - INDIAN CONSTITUTION

I. GOAL:

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES:

A) KNOWLEDGE:

At the end of the Phase - I MBBS course the student is expected to know:

1) Basic knowledge of the Indian Constitution.
2) Democratic institutions created by the Constitution.
3) Special rights created by the Constitution for regional and linguistic minorities.
4) Election Commission.
5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the Phase - I course the student is expected to make use of knowledge:

1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
2) To utilize State policies in their future practice.

COURSE CONTENTS

Theory: **25 Hours**

Unit I
a) Meaning of term Constitution.
b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
c) Salient Features of the Constitution.
d) Preamble of the Constitution. 2 Hours

Unit II	The democratic institutions created by the Constitution. Bicameral System of Legislature at the Centre and in the States. Devolution of Powers to Panchayat Raj Institutions.	5 Hours
Unit III	Fundamental Rights and Duties - Their content and significance	5 Hours
Unit IV	Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles.	1 Hour
Unit V	Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities	1 Hour
Unit VI	Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India.	4 Hours
Unit VII	The Election Commission and State Public Service Commissions.	2 Hours
Unit VIII	Method of amending the Constitution.	1 Hour
Unit IX	Enforcing rights through Writs Certiorari, Mandamus, Quo warranto and Hebeas Corpus.	2 Hours
Unit X	Constitution and Sustainable Development in India.	2 Hours

Scheme of Examination

Institutional Theory Examination at the end of the Phase- I MBBS Course: 100 Marks

Reference Books:

Sl. No.	Title	Author	Year of Publ.	Publisher
1	The Constitution of India – A Politico – Legal Study	J. C. Johari	-	Sterling Publication Pvt. Ltd.
2	Constitution Law of India	J. N. Pandey	1998	Central Law Agency
3	The Indian Constitution	Granville Austin	2000	Corner Stone of Nation Oxford

KANNADA

I. GOAL:

The students should gain knowledge of the local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

II. OBJECTIVES:

A) KNOWLEDGE:

At the end of the Phase - I MBBS course the student is expected to know:

1) The basic of Kannada Language.

2) To communicate and interact in Kannada Language with patients and colleagues.

B) SKILLS:

At the end of the Phase - I MBBS course the student is expected to:

1) Identify and write small words and sentences.

2) Acquire communicative skills.

3) Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

Theory:		**100 Hours**
1)	Interaction (small words & sentences)	15 Hours
2)	Introducing each other	04 Hours
3)	About Ramayana	04 Hours
4)	Enquiring about the College	04 Hours
5)	Enquiring about Room	04 Hours
6)	Vegetable Market	04 Hours
7)	About Medical College	04 Hours

8)	In a cloth shop	04 Hours
9)	Plan for a picnic	04 Hours
10)	Enquiring about one's family	04 Hours
11)	Conversation - between Doctor and Patient	05 Hours
12)	Enquiring about friend's family	05 Hours
13)	Conversation between friends	05 Hours
14)	Routine activities of students	05 Hours
15)	About children's education	05 Hours
16)	Halebidu and Belur	05 Hours
17)	Discussion about examination and future plan	05 Hours
18)	Karnataka: Lesson for reading	05 Hours
19)	Lesson for reading	05 Hours
20)	Presentation by students	04 Hours

Scheme of Examination

Institutional Theory Examination at the end of the Phase - I MBBS Course:100 Marks

Reference Books:

Sl. No.	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

Section V

Annexure 1

5.1 Different Methods Recommended for Internal Assessment By MCI

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

1) Credit for preparation and presentation of seminars by students.

2) Problem solving exercises.

3) Participation in project for health care in the community.

4) Proficiency in conducting a small Scientific project or assignment.

5) Multiple choice questions (MCQ) test after completion of a chapter / system.

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

Annexure II

5.2 Co-ordinated Programme in Theory for MBBS Phase-I of One Year Course in Anatomy, Physiology and Biochemistry

I term

Month	Anatomy	Physiology	Biochemistry	Integrated Teaching
1	General Anatomy General Embryology General Histology General Human Genetics	General Physiology Cell membrane Transport Homeostasis Body fluids Biophysical principles	Cell structure Sub-cellular components Biophysical principles, pH buffers Biochemistry of nucleic acids	
2	Osteology Myology Arthrology	Haematology Muscle physiology	Classification sources & functions of proteins, carbohydrate & lipids	Anatomy + Physiology + Biochemistry + Pathology
3 & 4	Heart, Blood vessels, Lungs, Pleura Systemic embryology	Cardiovascular system Respiratory system	Plasma proteins Protein synthesis Diagnostic enzymology	
5 & 6	Abdomen, Digestive and Genitourinary organs with systemic embryology Pelvis	Digestive system, secretion and motility Renal and reproductive physiology	Digestive enzymes, Vitamins, Digestion and absorption of food Liver function, detoxification, renal function, gastric function	

II term

Month	Anatomy	Physiology	Biochemistry	Integrated Teaching
7 & 8	Neuroanatomy Special senses Neural development	Nervous system Special senses Autonomic nervous system Endocrine glands	Metabolism of carbohydrates, amino acids, protein, fats, minerals, water.	Endocrine and exocrine pancreas (Diabetes mellitus) Anatomy + Physiology + Biochemistry
9 & 10	Brain, Cerebral cortex, Ventricular system, Brain coverings, Limbic system	Higher functions, Emotion, behaviour	Neurotransmitter, Radio isotopes, Biological oxidation, Electron transfer cycle	CSF Anatomy + Physiology + Biochemistry

Coordinated Programme for Dissection/Practical/Demonstration

I term

Month	Anatomy	Physiology	Biochemistry
1	Upper limb dissection Prosected part Histology tissues Muscles Bone marrow	Osmotic effect Osmotic hemolysis of RBC ESR Principles of hemocytometry	Viscosity, Principles of colorimetry pH-meter Spectrometry Sp. gravity of body fluids
2	Lower limb dissection Prosected part Histology – bone, connective tissue Embryology	Haemotology experiments Muscle experiments	Biochemistry test for carbohydrate, proteins, fats, minerals
3 & 4	Thorax, Abdomen Embryology model	Spirometry Stethography Artificial respiration FEV, Breath sounds	

II term

Month	Anatomy	Physiology	Biochemistry
5 & 6	Thorax Abdomen Pelvis Embryology model	Arterial pulse, Venous pulse Blood pressure, ECG (Demon) Echocardiography (Demon) Stress test Heart sounds	Urine examination Liver function test Renal function test
7 & 8	Head and Neck	Clinical examination of: • Cranial nerves • Sensory function • Motor function	Glucose tolerance test: Blood glucose estimation, Chemistry of food, Chemistry of milk
9 & 10	Brain	Examination of higher functions, reflexes	CSF analysis Urine: Physical and Chemical Estimation of Glucose in blood and urine (G.T.T.)

Annexure III

5.3 Topics for Integrated Teaching Programme During MBBS Phase - I Course

I term

Sl. No.	Topic	Department to organise	Department to participate
1	Anaemia	Physiology	Physiology, Biochemistry & Pathology
2	Jaundice	Biochemistry	Physiology, Biochemistry & Pathology
3	Coronary circulation	Physiology	Anatomy, Physiology & Biochemistry
4	Malnutrition and Starvation	Biochemistry	Physiology, Biochemistry & Community Medicine
5	Human Genetics	Anatomy	Anatomy, Biochemistry & Physiology

II term

Sl. No.	Topic	Department to organise	Department to participate
1	Acid base balance	Biochemistry	Biochemistry & Pathology
2	Thyroid gland	Anatomy	Anatomy, Physiology & Biochemistry
3	Pancreas	Anatomy	Anatomy, Physiology & Biochemistry
4	Stomach	Anatomy	Anatomy, Physiology & Biochemistry
5	Limbic system, Emotion, Learning	Physiology	Anatomy & Physiology
6	Growth & Development	Physiology	Anatomy & Physiology
7	Cerebral ventricles, CSF	Physiology	Anatomy & Physiology

Annexure IV

5.4 Categories of Bio-Medical Waste

SCHEDULE - I

(See Rule 5)

**Waste Category No.	Waste Category **Type	Treatment & Disposal **Options
Category No. 1	**Human Anatomical Waste** (human tissues, organs, body parts)	Incineration[0]/deep burial*
Category No. 2	**Animal waste** (animal tissues, organs, body parts, carcases, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals, colleges, discharge from hospitals, animal houses)	Incineration[0]/deep burial*
Category No. 3	**Microbiology & Biotechnology Waste** (wastes from laboratory cultures, stock or specimens of micro-organisms live or attenuated vaccines, human and animal cell culture used in research and infectious agents from research and industrial laboratories, wastes from production of biological, toxins, dishes and devices used for transfer of cultures)	Local autoclaving/micro-waving/incineration[0]
Category No. 4	**Waste sharps** (needles, syringes, scalpels, blades, glass, etc., that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection (chemical treatment[00]/autoclaving/micro-waving and mutilation/shredding[aa]
Category No. 5	**Discarded Medicines and Cytotoxic drugs** (wastes comprising of outdated, contaminated and discarded medicines)	Incineration[0]/destruction and drugs disposal in secured landfills

**Waste Category No.	Waste Category **Type	Treatment & Disposal **Options
Category No. 6	**Soiled waste (item contaminated with blood and body fluids including cotton, dressings, soiled plaster casts, lenins, bedding, other material contaminated)	Incineration[0]/autoclaving/ micro-waving
Category No. 7	**Solid waste** (waste generated from disposable items other than the waste **sharps such as tubings, catheters, intravenous sets, etc.)	Disinfection by chemical treatment[00]/autoclaving/ micro-waving and mutilation/shredding[00]
Category No. 8	**Liquid waste** (waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection by chemical treatment[00] and Discharge into drains
Category No. 9	**Incineration Ash** (ash from incineration of any bio-medical waste)	Disposal in multipall and fill
Category No. 10	**Chemical waste** (chemicals used in production of biological chemicals used in disinfection as insecticides, etc.)	Chemical treatment[00] and discharge into drains for liquids and secured land fill for solids

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

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

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

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

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

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

SCHEDULE-11

(See Rule 5)

Colour Coding	Type of Container	Waste Category	Treatment options as per Schedule-I
Yellow	Plastic bag	Cat. 1, Cat. 2 and Cat. 3, Cat. 6	Incineration/ deep burial
Red	Disinfected container/ plastic bag	Cat. 3, Cat. 6, Cat. 7	Autoclaving/ micro-waving/ chemical treatment
Blue/White Translucent	Plastic bag/ puncture proof container	Cat. 4, Cat. 7	Autoclaving/ micro-waving/ chemical treatment and destruction/shredding
Black	Plastic bag	Cat. 5 and Cat. 8 and Cat. 10 (solid)	Disposal in secured landfill

Notes:

1) Colour coding of waste categories with multiple treatment options as defined in Schedule - I shall be selected depending on treatment option chosen, which shall be as specified in Schedule.

2) Waste collection bags for waste types needing incineration shall not be made of chlorinated plastics.

3) Categories 8 and 10 (liquid) do not require containers/ bags.

4) Category 3 if disinfected locally need not be put in containers/bags.