

**MAHARISHI MARKANDESHWAR UNIVERSITY**

**LADO, SULTANPUR ROAD, KUMARHATTI-SOLAN (H.P)-173-229**

(Established under H.P.Govt.Act.No.22 of 2010 and approved  
by the UGC under section 22 of the UGC Act, 1956)



**Syllabus  
of  
Bachelor of Medicine  
&  
Bachelor of Surgery (MBBS)  
2013**

## Bachelor of Medicine and Bachelor of Medicine (MBBS)

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**\* Ordinance : Bachelor of Medicine and Bachelor of Surgery (M. B. B. S.)**

1. Course duration: 5 ½ Years (including one year compulsory rotatory Internship)

1.1 Examinations: 4 (Four) Examinations as detailed below:

**1.2 Training Period and Time Distribution**

- (1) Every student shall undergo a period of certified study extending over 4 ½ years divided into 9 semesters ( i.e. of 6 months each) from the date of commencement of his study, for the subjects comprising the medical curriculum to the date of completion of examination and followed by one year compulsory rotating internship.
- (2) The period of 4 ½ years is divided into three phases as follows:-
  - (a) Phase-1 (two semesters)- consisting of Pre-clinical subjects (Human Anatomy, Physiology including Bio-Physics, Bio-chemistry and introduction to Community Medicine including Humanities).
  - (b) Phase-II (3 semesters)- consisting of para-clinical/clinical subjects.  
During the phase teaching of para-clinical and clinical subjects shall be done concurrently. The para- clinical subjects shall consist of Pathology, Pharmacology, Microbiology, Forensic Medicine including Toxicology and part of Community Medicine.
  - (c) Phase-III(Continuation of study of clinical subjects for seven semesters after passing Phase-I). The clinical subjects to be taught during Phase II and III are Medicine and its allied specialities, Surgery and its allied specialities , Obstetrics and Gynaecology and Community Medicine.

**1.3 Phase Distribution and Timing of Examinations**

<b>Examination &amp; Period of study</b>	<b>Subjects</b>	<b>Annual</b>	<b>Supplementary</b>
<b>Phase-I</b> MBBS 1 <sup>st</sup> Prof. (1 <sup>st</sup> & 2 <sup>nd</sup> Semester)	Anatomy Physiology Biochemistry	June-July (during 2 <sup>nd</sup> Semester)	September
<b>Phase-II</b> MBBS 2 <sup>nd</sup> Prof. (3 <sup>rd</sup> , 4 <sup>th</sup> & 5 <sup>th</sup> Semester)	Pathology Microbiology Pharmacology Forensic Medicine	December (during 5 <sup>th</sup> Semester)	March

**Final Prof. MBBS in 2 Parts-Concurrently with Phase II in Sems. 3<sup>rd</sup> 4<sup>th</sup> & 5<sup>th</sup>**

<b>Phase-III</b> MBBS Third Prof.(Part-I) (3 <sup>rd</sup> to 7 <sup>th</sup> Semester)	Ophthalmology Oto-Rhino-Laryngology Community Medicine	December (during 7 <sup>th</sup> Semester)	March
MBBS Third Prof. (Part II) (3 <sup>rd</sup> to 9 <sup>th</sup> Semester)	Medicine Surgery Obstetrics and Gynaecology Paediatrics	December (during 9 <sup>th</sup> Semester)	March

Note:-(1) The academic year shall include the time for examinations and preparatory holidays.

(2) There shall be one main examination in a year and a supplementary to be held not later than 6 months after the publication of its results.

(3) Training of Final Prof.(Part-I) and (Part-II) will start simultaneously with 2<sup>nd</sup> Prof. after passing 1<sup>st</sup> Prof. MBBS examination.

**2. Qualifications for joining the MBBS Course.**

2.1 A person who shall attain the age of 17 years or more on December 31 of the year of admission and has passed one of the following examinations shall be eligible to join First Professional Bachelor of Medicine and Bachelor of Surgery (M.B.B.S.) Course:-

- (i) Senior School Certificate Examination (10+2) of Board of School Education, Haryana or an examination recognized as equivalent there to or Senior Secondary Examination (12<sup>th</sup>), Pre-Medical or Plus Two or an equivalent examination from any Indian/Foreign Universities/Boards with at least 50% Marks in English and 50% marks in Physics, Chemistry and Biology taken together in qualifying examination;  
Provided further that the percentage of marks as specified above will be reduced to 40% in case of candidates belonging to SC/ST.

**3. Eligibility for appearing in various Examinations :-**

3.1 A student who satisfies the following requirements duly certified by the Principal of concerned Medical college, shall be eligible to appear in the first professional MBBS Examination:

- (a) of having good character;  
(b) of having enrolled in the college for a period of one year as specified earlier.  
(c) of having attended the prescribed course;  
(d) of having attended not less than 75% of the full course of lectures delivered including non lectures teaching i.e. Seminars, Group discussion, Tutorials, demonstrations and Practicals held separately in Anatomy, Physiology and Biochemistry; and any other subject prescribed in the syllabus as approved by the Academic Council.  
(e) of having obtained at least 35% marks in internal assessment.

3.2 A student who has passed First Professional MBBS examination after fulfilling the requirements laid down in Clause 3.1 and satisfies the following requirements duly certified by the Principal of concerned Medical College shall be eligible to appear in the Second Professional MBBS Examination:

- (a) of having good character;  
(b) of having enrolled in 2<sup>nd</sup> Professional MBBS Course of the college for the period provided in clause 1. (i.e.18 months)  
(c) of having attended the prescribed course;  
(d) of having attended not less than 75% of the full course of lectures delivered including non lectures teaching i.e. Seminars, Group discussion, Tutorials, demonstration, Practicals, Hospital clinical posting and bed side clinics etc. held separately in Pharmacology, Pathology, Microbiology and Forensic Medicine and any other subject prescribed in the syllabus as approved by the Academic council.  
(e) of having obtained at least 35% marks in internal assessment.

3.3 A student who has passed 2<sup>nd</sup> Professional MBBS examination after fulfilling the requirements laid down in Clause 3(ii) and satisfies the following requirements duly certified by the Principal of concerned Medical College shall be eligible to appear in the Part-I of Third Professional MBBS Examination:

- (a) of having good character;  
(b) of having enrolled in the college for the period provided in clause 1 and must have passed 2<sup>nd</sup> Prof. MBBS Exam.  
(c) of having attended the prescribed course;  
(d) of having attended not less than 75% of the full course of lectures delivered including non lectures teaching

i.e. Seminars, Group discussion, Tutorials, demonstration, Practicals, Hospital Clinical posting and bed side clinics etc. held in each of the subjects of examination.

- (e) of having obtained at least 35% marks in internal assessment.
- 3.4 A student who has passed Third Prof. Part-I examination after fulfilling the requirements laid down in Clause 3(iii) and satisfies the following requirements duly certified by the Principal of concerned Medical College shall be eligible to appear in the Part-II of Third Professional MBBS Examination:
- (a) of having good character;
- (b) of having enrolled in the college for the period provided in clause 1 and must have passed Final Prof. Part I examination.
- (c) of having attended the prescribed course;
- (d) of having attended not less then 75% of the full course of lectures delivered including non lectures teaching i.e. Seminars, Group discussion, Tutorials, demonstration, Practicals held separately in each of the subjects in which he is to be examined as well as in all major specialities to which a candidate is posted.
- (e) of having obtained at least 35% marks in internal assessment.
- (f) of having been engaged in practical/clinical work at a recognized hospital for a Period of three and half years to the satisfaction of the Head of the College after passing the first professional MBBS Examination. Details of this practical/Clinical training are given as under:-

Department	Period of posting
Medicine	26 weeks
Surgery	26 weeks
Eye	10 weeks
ENT	8 weeks
Obst. & Gynae.	24 weeks
	(inclusive maternity training)
Paediatrics	10 weeks
Orthopaedics	10 weeks
Tuberculosis	2 weeks
Psychiatry	2 weeks
Skin & V.D.	6 weeks
Anesthesiology	2 weeks
Radiology	2 weeks
Community Medicine	12 weeks
Casualty	2 weeks
Dental	2 weeks

Or any other programme laid down by the Dean, Faculty of Medical Sciences/Dean/Principal of the Medical College. The theory lectures and syllabus in various subjects will be as laid down in MCI regulations from time to time.

**Provided Further That :**

- (a) Passing in Ist Professional is compulsory before proceeding to Phase II training.
- (b) A student who fails in the IInd Professional examination, shall not be allowed to appear in IIIrd Professional Part I examination unless he passes all subjects of IInd Professional examination.
- (c) Passing in IIIrd Professional (Part I) examination is not compulsory before entering IIIrd Professional Part II training, however passing of IIIrd Professional (Part I) is compulsory for being eligible to appear in IIIrd Professional (Part II) examination.

**Note :** There will be only two examinations in a year, one main and one supplementary examination should be conducted within 6 months so that the students who pass in supplementary can join the main batch and the failed students will have to appear in the subsequent year.

3.5 A candidate who does not fulfill the conditions laid down for all the subjects of examination may be allowed to take the examination in the subject in which the candidate has fulfilled the conditions.

#### **4. General eligibility provisions for appearing in any Examination :**

4.1 A person who has passed the First Professional M.B.B.S. Examination of this University shall be eligible to join the Second Professional M.B.B.S. Course. A person not having passed in the main/supplementary examination of 1<sup>st</sup> Prof. MBBS shall not be eligible to join 2<sup>nd</sup> Professional MBBS Course.

4.1(A) The Supplementary examination for First Professional MBBS Examination shall be conducted with in 6 months so that the students who pass can join the main batch and the failed students will have to appear in the subsequent year, provided that the students who pass the Supplementary examination shall be allowed to appear in the Second Professional Examination only after he/she completes the full course of study of three semesters (i.e. 18 months) for the Second Professional MBBS examination irrespective of the examination of the main batch.

4.2 A person who has passed the Second Professional M.B.B.S. Examination of this University shall be eligible to join Part-I of final Professional M.B.B.S Course. However a candidate who fails in the Second Professional Examination may be allowed to attend the Part-I of Third Professional MBBS Course but will not be allowed to appear in the Part-I of Third Professional Examination till he passes in all the subjects of Second Professional Examination.

4.3 A person who has passed Part-I of final Professional M.B.B.S. Examination of this University shall be eligible to join Part-II of final Professional M.B.B.S. However, a candidate who fails in the Part-I of Third M.B.B.S. Examination may be allowed to attend the next higher class i.e. Part-II of Third Professional M.B.B.S. Course but will not be allowed to appear in the examination of Part-II of Third Professional M.B.B.S. till he passes in all the subjects of Part-I Third Professional M.B.B.S. Examination.

5. A deficiency in the required number of lecturers, clinical and Practicals may be condoned by the Principal up to the extent of 5% in hard and deserving cases.

6. A candidate who has completed the prescribed course as laid down in these Clauses and is unable to appear in the examination or having appeared has failed, may be admitted to subsequent examinations, on payment of the prescribed fee on each occasion and on presenting a certificate signed by the Principal of Medical College/Institution in which he has completed the course that he has subsequent to his last failure attended a course of training/hospital practice in the subjects of the examination as the Principal may determine:-

#### **7. EXAMINATIONS:**

7.1 A candidate not passing in Main/Supplementary Examination will attend classes, seminars, Practicals etc. as decided by the Principal in the subjects in which he/she is to appear at next examination.

7.2 The examination shall be held according to the scheme of examination and syllabus prescribed by Medical Council of India and adopted by the Academic Council. A candidate who fails in an examination or having been eligible fails to appear in an examination shall take the examination according to the syllabus prescribed by the University for regular students provided that the syllabus for the candidates of supplementary examination shall be the same as was in force in the last main examination.

20% of the total marks in each subject of every examination separately for theory & practical/clinical shall be reserved for internal assessment determined by regular periodical examination and day to day

assessment and certified class work. The marks of internal assessment will be divided equally between theory and practical.

7.3 The medium of examination shall be English.

7.4 The amount of examination fee to be paid by a candidate for each examination i.e. First/Second/Third (Part-I/Part-II) Professional examination shall be as prescribed by the University from time to time.

#### 8. Passing Score:

8.1 The minimum number of marks required to pass in each examination i.e.

First/Second/Third (Part-I/Part-II) Professional shall be 50% marks in aggregate in each of the subjects separately with a minimum of 50% marks in theory (including oral examination) and clinical/practical separately inclusive of internal assessment, as the case may be.

8.2 A candidate who obtains pass marks in one or more subject(s) need not appear in that/those subject(s) again in any subsequent examination.

8.3 As soon as possible, after termination of the examination, the Controller of Examinations shall publish the result of the candidates and issue Detailed-Marks-Card/Certificate.

8.4 Successful candidates who obtain 75% or more marks in any subject shall be declared to have passed with "distinction" in that subject provided he/she passes in all the subjects of the examination at one and the same time.

8.5 A successful candidate of the Third Professional M.B.B.S. examination shall be granted the degree after he has completed the post examination internship training as prescribed.

#### 9. DISTRIBUTION OF MARKS TO VARIOUS DISCIPLINES:

##### (A) FIRST PROFESSIONAL EXAMINATION: (Pre-clinical Subjects):-

Each paper shall have two sections. Questions requiring essay type answers may be avoided.

##### (i) Anatomy :

Theory-Two papers of 50 marks each	
(One applied question of 10 marks in each paper)	100 marks
Oral (Viva)	20 marks
Practical	40 marks
Internal Assessment	40 marks
(Theory-20; Practical-20)	
Total	200 marks

##### (ii) Physiology including Biophysics :

Theory-Two papers of 50 marks each	
(One applied question of 10 marks in each paper)	100 marks
Oral (Viva)	20 marks
Practical	40 marks
Internal Assessment	40 marks
(Theory-20; Practical-20)	
Total	200 marks

##### (iii) Biochemistry :

Theory-Two papers of 50 marks each	
(One applied question of 10 marks in each paper)	100 marks
Oral (Viva)	20 marks
Practical	40 marks
Internal Assessment	40 marks
(Theory-20; Practical-20)	

Total 200 marks

**Pass:** In each of the subjects, a candidate must obtain 50% in aggregate with a minimum of 50% in Theory including orals and minimum of 50% in Practicals separately.

**(B) SECOND PROFESSIONAL EXAMINATION: (Para-clinical subjects):**

Each paper shall have two sections. Questions requiring essay type answers may be avoided.

**(i) Pathology :**

Theory-Two papers of 40 marks each (One applied question of 10 marks in each paper)	80 marks
Oral (Viva)	15 marks
Practical	25 marks
Internal Assessment (Theory-15; Practical-15)	30 marks
<b>Total</b>	<b>150 marks</b>

**(ii) Microbiology :**

Theory-Two papers of 40 marks each (One applied question of 10 marks in each paper)	80 marks
Oral (Viva)	15 marks
Practical	25 marks
Internal Assessment (Theory-15; Practical-15)	30 marks
<b>Total</b>	<b>150 marks</b>

**(iii) Pharmacology :**

Theory-Two papers of 40 marks each Containing one question on clinical therapeutics	80 marks
Oral (Viva)	15 marks
Practical	25 marks
Internal Assessment (Theory-15; Practical-15)	30 marks
<b>Total</b>	<b>150 marks</b>

**(iv) Forensic Medicine :**

Theory-one paper	40 marks
Oral (Viva)	10 marks
Practical/Clinicals	30 marks
Internal Assessment (Theory-10; Practical-10)	20 marks
<b>Total</b>	<b>100 marks</b>

**Pass:** In each of the subjects, a candidate must obtain 50% in aggregate with a minimum of 50% in Theory including oral and minimum of 50% in Practicals/clinical.

**(C) THIRD PROFESSIONAL**

Each paper shall have two sections. Questions requiring essay type answers may be avoided.

**(i) PART - I (Clinical subjects)**

Part - I: To be conducted during end period of seventh semester

**(a) Ophthalmology :**

Theory-One paper (should contain one question on pre-clinical and Para-clinical aspects, of 10 marks)	40 marks
Oral (Viva)	10 marks
Clinical	30 marks



Internal Assessment	20 marks
(Theory-10; Practical-10) Total	100 marks
<b>(b) Oto-Rhino-Laryngology (ENT):</b>	
Theory-One paper (should contain one question on pre-clinical and Para-clinical aspects, of 10 marks)	40 marks
Oral (Viva)	10 marks
Clinical	30 marks
Internal Assessment	20 marks
(Theory-10; Practical-10) Total	100 marks
<b>(c) Community Medicine including Humanities:</b>	
Theory-Two papers of 60 marks each (includes problem solving, applied aspects of management at primary level including essential drugs, occupational (agro based) diseases, rehabilitation and social aspects of community).	120 marks
Oral (Viva)	10 marks
Practical/Project evaluation	30 marks
Internal Assessment	40 marks
(Theory-20; Practical-20) Total	200 marks

**Pass:** In each of the subjects, a candidate must obtain 50% in aggregate with a minimum of 50% in Theory including orals and minimum of 50% in Practicals/clinicals.

**(ii) PART - II**

Each paper shall have two sections. Questions requiring essay type answers may be avoided.

**(a) Medicine :**

Theory – Two papers of 60 marks each	120 marks
Paper - I – General Medicine	
Paper - II – General Medicine (including Psychiatry, Dermatology and S. T.D.)	
(Shall contain one question on basic sciences and allied subjects)	
Oral (viva) Interpretation of X-ray, ECG, etc.	20 marks
Clinical (Bed side)	100 marks
Internal assessment	60 marks
(Theory 30, Practical 30) Total	300 marks

**(b) Surgery :**

Theory – Two papers of 60 marks each	120 marks
Paper - I – General Surgery (section 1) Orthopaedics (section 2)	
Paper - II – General Surgery (including Anaesthesiology, Dental diseases and Radiology.)	
(Shall contain one question on basic sciences and allied subjects)	
Oral (viva) Interpretation of Investigative data	20 marks
Clinical (Bed side)	100 marks
Internal assessment	60 marks
(Theory 30, Practical 30) Total	300 marks

Paper - I of Surgery shall have one section in Orthopaedics. The questions on Orthopaedic Surgery be set and assessed by examiners who are teachers in the Orthopaedic surgery.

**(c) Obstetrics and Gynaecology :**

Theory – Two papers of 40 marks each	80 marks
Paper - I – Obstetrics including social obstetrics	
Paper - II – Gynaecology, Family Welfare and Demography	

(Shall contain one question on basic sciences and allied subjects)	
Oral (viva) including record of delivery cases (20+10)	30 marks
Clinical	50 marks
Internal assessment	40 marks
(Theory 20, Practical 20)	Total 200 marks

**(d) Paediatrics : (including Neonatology)**

Theory – One paper	40 marks
(Shall contain one question on basic sciences and allied subjects)	
Oral (viva)	10 marks
Clinical	30 marks
Internal assessment	20 marks
(Theory 10, Practical 10)	Total 100 marks

**Pass :** In each of the subjects a candidate must obtain 50% in aggregate with a minimum of 50% in Theory including orals and minimum of 50% in Practicals/clinicals.

**10. Grace Marks**

- 10.1 The grace marks up to a maximum of five marks may be awarded at the discretion of the University to a student who has failed only in one subject but has passed in all other subjects.
- 10.2 Revaluation of Theory papers in any MBBS examination will not be permissible. However re-totalling can be allowed.

**11. Appointment of External / Internal Examiners for various examinations leading to the award of MBBS Degree.**

- 11.1 No persons shall be appointed as an examiner in any of the subjects of the professional examinations leading to and including the final professional examination for the award of the M.B.B.S. degree unless he has taken at least five years previously, a doctorate degree of a recognised University or an equivalent qualification in the particular subject as per recommendations of the Medical Council of India on teachers eligibility qualifications and has had at least five years of total teaching experience in the subject concerned or in allied subjects in a college affiliated to a recognized University and holds the rank of Assoc. Prof. or above.
- 11.2 There shall be at least five examiners out of whom not less than 2 must be external examiners. Of the five examiners the seniormost internal examiner will act as the Chairman and Co-Ordinator of the whole examination programme so that uniformity in the matter of assessment of candidate is maintained. The Board of studies shall supply the panel of examiners to University for appointment of internal/external examiners by the Vice- Chancellor. The panel of External examiners shall include at least double the number of examiners to be appointed.
- 11.3 In the case where there are two question papers in one subject, junior most internal examiner will not be a paper-setter and will not mark the theory answer-books also. Where there is one paper in a subject, the senior most internal examiner will be the paper-setter in the respective examination. In case eligible internal examiners are not available in a particular subject, the examination may be conducted with less than 3 (but atleast one) internal examiners.
- There will be six examiners in the subject of Surgery (for both Annual & Supplementary examinations) in MBBS 3rd professional (Part-III) Examinations out of which two (one external and one internal) will be from Orthopaedics and that only external examiner will evaluate the Orthopaedics part of Surgery Paper.
- 11.4 Non-Medical Scientists engaged in the teaching of Medical student may be appointed examiners in their concerned subject provided that they possess requisite qualifications and five year teaching experience of teaching medical students after obtaining their postgraduate qualifications from medical faculty.
- 11.5 External examiners should preferably be from outside the State / University.
- 11.6 The external examiner should rotate at an interval of one year.
- 11.7 There shall be a Chairman of Board of paper-setters who shall be the senior most internal examiner and shall moderate the question papers. The question papers shall be set jointly by the External/Internal Examiners. The external examiner shall send the papers to the convenor examiner (Chairman)

11.8 The question papers in theory of the various subjects shall be set as under:-

**(i) First Prof. M.B.B.S. Examination**

Anatomy	Paper-A	Part-I External Examiner Part-II External Examiner
	Paper-B	Part-I Internal Examiner (Convener) Part-II Internal Examiner
Physiology	Paper-A	Part-I External Examiner Part-II External Examiner
	Paper-B	Part-I Internal Examiner (Convener) Part-II Internal Examiner
Bio-chemistry	Paper-A	Part-I External Examiner Part-II External Examiner
	Paper-B	Part-I Internal Examiner (Convener) Part-II Internal Examiner

**(ii) Second Prof. M.B.B.S. Examination**

Pharmacology	Paper-A	Part-I External Examiner Part-II External Examiner
	Paper-B	Part-I Internal Examiner (Convener) Part-II Internal Examiner
Pathology	Paper A	Part-I External Examiner Part-II External Examiner
	Paper B	Part-I Internal Examiner (Convener) Part-II Internal Examiner
Forensic Medicine	One Paper only	Part-I External Examiner Part-II Internal Examiner (Convener)
Microbiology	Paper A	Part-I External Examiner Part-II External Examiner
	Paper B	Part-I Internal Examiner (Convener) Part-II Internal Examiner

**(iii) Third Prof. M.B.B.S. Part-I**

Ophthalmology	One Paper only	Part-I External Examiner Part-II Internal Examiner (Convener)
Oto-Rhino-Laryngology (ENT)	One Paper only	Part-I External Examiner Part-II Internal Examiner (Convener)
Community Medicine Including Humanities	Paper-A	Part-I External Examiner Part-II External Examiner
	Paper-B	Part-I Internal Examiner (Convener) Part-II Internal Examiner

**(iv) Third Prof. M.B.B.S. Part-II**

Medicine	Paper A	Part-I External Examiner Part-II External Examiner
	Paper B	Part-I Internal Examiner (Convener) Part-II 2 <sup>nd</sup> Internal Examiner
Surgery	Paper A	Part-I External Examiner Part-II External Examiner

	Paper B	Part-I Internal Examiner (Convener) Part-II Ortho. Examiner (Internal or External as the case may be)
Obst. & Gynae.	Paper A	Part-I External Examiner Part-II External Examiner
	Paper B	Part-I Internal Examiner (Convener) Part-II Internal Examiner
Paediatrics		Part-I External Examiner Part-II Internal Examiner (Convener)

- 11.9 The paper-setter for a particular part/paper shall also be the theory examiner for the same part / paper. In the event of the paper-setter not being available for evaluating the answer-books or unable to conduct the practical examination, EXAMINER conducting the practical examination shall evaluate the relevant theory paper.
- 11.10 There shall be separate sets of examiners for each College (in case there are multiple colleges in a city) with internal examiners from the concerned College. Head of the Department will be one of the examiners.
- 11.11 All professors/teachers with the rank of Associate Professor or equivalent and above with requisite qualifications and experience shall be appointed internal examiners by rotation in their subjects.
- 11.12 An external examiner may ordinarily be appointed for not more than 1 year consecutively. Thereafter he may be reappointed after a gap of 1 year.
- 11.13 The same set of examiners shall ordinarily be responsible for the written, practical and oral examinations.
- 11.14 There shall be a Chairman of the Board of paper-setters who shall be the convener internal examiner and shall moderate the question papers.
- 11.15 The Head of the Department shall be First internal examiner, second internal examiner shall rotate every year amongst eligible internal examiners. The Board of Studies shall supply the panel of examiners to the University for appointment of internal/external examiners by the Vice-Chancellor.

## 12. GENERAL PROVISIONS

- 12.1 In case of non-availability of an external examiner for the practical examination in respect of any of the examinations, the Dean Faculty of Medical Sciences / Principal shall have the authority to appoint any other eligible Teacher/Prof. in the subject from any other recognized Medical College in the country. He will also be entitled to solve, if any, other difficulty that arises in the appointment of examiners/conduct of examination in any of the subjects.
- 12.2 The senior (Coordinator) internal examiner shall hand over the final results duly signed by the external and internal examiners to the Controller of Examinations immediately on the termination of the examination.  
Note: - Any issue (s) uncovered shall be as per MCI Regulations as amended from time to time.

## 13. INTERNSHIP.

- 13.1 Every candidate will be required after passing the Third Prof.(Part-II) MBBS examination to undergo compulsory rotational internship to the satisfaction of the College authorities and University concerned for a period of 12 months so as to be eligible for the award of the degree of Bachelor of Medicine and Bachelor of Surgery (MBBS) and full registration.
- 13.2 The University shall issue a provisional MBBS pass certificate(award sheet) on passing the final Prof. (Part-II) examination.
- 13.3 The State Medical Council will grant provisional registration to the candidate on production of the provisional MBBS pass certificate. The provisional registration will be for a period of one year. In the event of shortage or unsatisfactory work, the period of provisional registration and the compulsory rotating internship may be suitably extended by the appropriate authorities.
- 13.4 The intern shall be entrusted with clinical responsibilities under direct supervision of seniors. They shall not be working independently.
- 13.5 Interns will not issue a medical certificate or a death certificate or a medicolegal document under their signature.

- 13.6 All parts of the internship shall be done as far as possible in institutions in India.
- 13.7 Internship is a phase of training wherein a graduate is expected to conduct actual practice of medical and health care and acquire skills under supervision so that he/she may become capable of functioning independently.
- 13.8 At the end of 12 months internship, a certificate of satisfactory completion of training shall be issued by the Principal/Dean of the college following which the University shall award the MBBS degree or declare him/her eligible for it.
- 13.9 The evaluation during internship training, time distribution in various departments/ hospitals and any other issues left uncovered shall be as per MCI Regulations.

**DEPT OF ANATOMY, M M MEDICAL COLLEGE, SOLAN**

**First professional MBBS**

**SUBJECT: ANATOMY**

**Distribution of marks and syllabus**

		<b>THEORY</b>	
		<b>Syllabus\Topics</b>	<b>No.of questions</b>
Paper-A	Part -I	Shall consist of Head and Neck (including its Embryology And Histology),General Anatomy	Six questions(three in each part) Each part may have one long question and other Short notes.
	Part-II	Shall consist of brain, spinal cord, Upper Limb (including its embryology And histology), General Histology	
Paper-B	Part-I	Shall consist of abdomen and pelvis (including its Embryology and Histology), General Embryology.	
	Part-II	Shall consist of Thorax, Lower limb (including its Embryology and Histology) Question papers should have questions of short answer type.	

**DISTRIBUTION OF MARKS**

Theory –Two papers of 50 marks each (one applied question of 10 marks in each paper)	100 marks
Oral (viva)	20 marks
Practical	40 marks
Internal Assessment (Theory-20; Practical-20)	40 marks
Total	200 marks

## TEACHING HOURS SCHEDULE

Discipline	Lecture Hours	Practical Hours	Dissection Hours	Total Available Hours	MCI Prescribed Hours.
Anatomy	8hr/week X 36 =288	6hr/week X 36 =216	6hr/week X 36 =216	720	650

## SYLLABUS

**A. Gross Anatomy:** Gross Anatomy of the entire human body which will consist of the following:

- 1) **Osteology:** Age changes and blood supply of all bones. Individual skull bones, small bones of hand and foot (details excluded).
- 2) **Arthrology:** classification and structure of various types of joints. Study of the structure, relation, functions, vascular and nerve supply and applied anatomy of all major joints.
- 3) **Myology:** attachments, action, nerve supply of all muscles and relations of important muscles.
- 4) **Vascular system:** structure of heart including the anatomy of individual chambers, valves, coronary circulation, nerve supply, pericardium and relations. Course, relations, branches, distribution, anastomoses of all arteries and veins including venous sinuses.  
Lymphatic drainage of all parts and organ of the body. Position and relations of various groups of lymphnodes. Course and relationship of major lymph vessels. Arterial supply, venous and lymphatic drainage of the entire body.
- 5) **Nervous system:** coverings of the brain and spinal cord, formation and circulation of cerebro-spinal fluid. Anatomy of brain including external and internal structure of subdivisions. Cortical and nuclear connections; ventricles, commissures, blood supply. Anatomy of spinal cord, including its internal structure, regional differences, blood supply, related nerves and ganglia. Study of nervous pathways.

- 6) **Peripheral nervous system** including origin, course, relations, branches, distribution, composition of all cranial and spinal nerves, autonomic nervous system including the central and peripheral connections of the sympathetic and parasympathetic ganglia and their relationship.
- 7) **Splanchnology**: study of the size, position, shape, relation, blood supply, lymphatic drainage, nerve supply and structure of all viscera and organs including the respiratory, digestive, urogenital systems and endocrine glands.
- 8) **Special sense organs**: Anatomy of the peripheral sense organs of taste, smell, sight, hearing and the skin.

**B. EMBRYOLOGY** : general embryology including cyclical changes in female genital tract, formation and maturation of germ cells, fertilization , segmentation and implantation. Formation, structure, anomalies, circulation, types and function of placenta.

Differentiation of fertilized ovum and development of the embryo up of formation of germ layers, development of membranes. Physiology of maintenance and termination of pregnancy; regional embryology including the process of development of all tissues and organs of the body. Developmental anomalies and their causation and effects.

**C. HISTOLOGY AND GENERAL ANATOMY**: histology of all cells, tissues and organs of the body. General principles governing the structure, function, growth and regeneration of various tissues.

**D. APPLIED ANATOMY**: Anatomy as applied to surgery, medicine, obstetrics and gynecology, family welfare, ophthalmology and other specialized disciplines of medical science.

**E. FUNCTIONAL ANATOMY**: Relationship of structure and function in respect of various tissues and organs of the body.

**F. LIVING ANATOMY**: Surface anatomy, radiological anatomy including principles of modern imaging techniques.



## RECOMMENDED BOOKS IN ANATOMY

1. Human Anatomy Regional and Applied Dissection and Clinical Vol.I,II,III – B.D.Chaurasia
2. Textbook of Anatomy Vol I,II,III – Inderbir Singh
3. Cunningham's Manual of Practical Anatomy Vol I,II,III
4. Human Embryology – Inderbir Singh
5. Textbook of Human Histology – Inderbir Singh
6. Textbook of Human Neuroanatomy - Inderbir Singh
7. Difiore's Atlas of Histology with Functional Correlation – Eroschenko
8. Snell's Clinical Anatomy
9. Surface and Radiological Anatomy – A.Halim
10. Textbook of Human Osteology - Inderbir Singh

## REFERENCE BOOKS

1. Gray's Anatomy

## 2. \*SUBJECT: BIOCHEMISTRY

### Distribution of marks and syllabus

**THEROY:**  
**PAPER-A: PART-I**

#### **SYLLABUS TOPICS**

STRUCTURE AND FUNCTIONS OF CELL AND SUB-CELLULAR ORGANELLES BIOMEMBRANCES AND TRANSPORT SYSTEM FUNDAMENTAL ASPECTS OF ENZYMOLOGY AND CLINICAL SIGNIFICANCE OF ENZYMES, CHEMISTRY AND FUNCTIONS OF BIOMOLECULES(CARBOHYDRATES,LIPIDS,PROTEI NS AND AMINO ACID AND NUCLEIC ACID INCLUDING NUCLEOPROTEINS) DIGESTION AND ABSORPTION OF NUTRIENTS, BIOLOGICAL OXIDRATION, ELECTION TRANSPORT CHAIN AND OXIDATIVE PHOSPHORYLATION.

**NO.OF QUESTIONS**  
SIX QUESTIONS (THREE IN EACH PART) \*EACH PART MAY HAVE ONE LONG QUESTION & OTHER AS SHORT NOTES.

#### **PART-II**

METABOLISM OF CARBOHYDRATES, LIPIDS, PROTEINS AND NUCLEIC ACIDS, METABOLIC INTERGRATION; METABOLIC DISORDERS; MACHANISM OF ACTION OF HORMONES, BIOSYNTHEISE, SECRETION AND METABOLIC EFFECTS OF HORMONES OF ADRENALS, THYROID, PARATHYROID AND PANCREAS GLAND AND RELATED DISORDERS, HOMRNORMAL REGULATION OF METABOLISM.

#### **PAPER-B: PART-I**

BASIC ELEMENTS OF NUTRITION, NUTRITION IN HEALTH AND MALNUTRITION DISEASES; WATER AND FAT SOLUBLE VITAMINS; MINERALS METABOLISM; AND DEFICIENCY DISEASES; BASIC CONCEPTS OF IMMUNOLOGY; WATER AND ELECTROLYTE METABOLISM; REGULATION OF ACID BASE BALANCE AND RELATED DISORDERS.

#### **PART-II**

MOLECULAR BIOLOGY OF GENE AND REGULATION OF GENE EXPRESSION; BIOCHEMICAL GENETICS AND GENETIC ENGINEERING; XENOBIOTICS METABOLISM; BIOCHEMICAL ASPECTS OF CANCER AND CHEMICAL CARCINOGENESIS; ORGAN FUNCTION TEST (LIVER, KIDNEY, THYROID, PANCREATIC AND GASTRIC INTERPRETATION OF CLINICAL INVESTIGATIONS).

## DETAILED THEORY SYLLABUS

### THE CELL:

Structure and Function of Cell and Subcellular Organelles; Biomembranes: Structural organization and Biological Functions including Transport System.

### BIOLOGICAL OXIDATION:

Definition and types of Biological Oxidation; Concept of High Energy Compounds. Electron Transport Chain (ETC) along with Uncouplers and Inhibitors. Mechanism of Oxidative Phosphorylation.

### VITAMINS AND COENZYMES:

Classification, biochemical functions and deficiency symptoms of water and fat soluble vitamins. Basic elements of nutrition.

### ENZYMES:

Definition and classification of Enzymes, Coenzymes, holoenzymes, Apoenzymes, Isoenzymes and metalloenzyme. Catalytic site, Mechanism of action; Factors affecting the velocity of enzyme catalysed reaction e.g pH, Temperature and substrate Concentration; Enzyme inhibition and its Clinical Significance. Regulation of Enzyme activity (Feedback and Allosteric regulation). Diagnostic importance of enzymes (Liver and Heart).

### CARBOHYDRATES:

CHEMISTRY AND FUNCTION: Classification; Chemistry of mono, disachharides and polysachharides, Isomerism in Carbohydrates (Stereoisomerism, Optical isomerism, Epimers, Anomers and Mutarotaion). Concept of Glycoproteins, Proteoglycans, Glycolipids, Aminosugars and Glycosides (Without detailed structure).

METABOLISM: Digestion and absorption of dietary Carbohydrates; Glycolysis, TCA-Cycle, Glycogenesis, Glycognolysis, Hormonal regulation, Glycogen Storage Diseases, Gluconeogenesis, HMP-Shunt, Uronic acid pathway, Concept of Galactose and fructose metabolism; Bioenergetics, Biomedical Importance, Metabolic Disorders and Regulations.

GTT: Clinical importance of GTT and study of abnormal glucose absorption curves, Regulation of Blood sugar, Glycosurias and Diabetes Mellitus.

### LIPIDS:

Classification, Biomedical importance and function of Saturated, Unsaturated and Essential Fatty acids, Triglycerides, Phospholipids, Glycolipids, Sulfatides and Lipoproteins.

Cholesterol: Structure, Functions and its derivatives. Prostaglandins: classification and functions. Concept of Prostacyclines, Leukotrienes and Thromboxanes.

**METABOLISM:** Digestion and absorption of lipids, Fattyacid synthesis,  $\beta$ -oxidation of Fatty acids along with inborn errors of metabolism.

**CHOLESTEROL:** Synthesis, catabolism, regulation, inborn errors of metabolism and Atherosclerosis.

Concept of Apoproteins, Lipoproteins, transport and disorders, lipotropic factors and Fatty liver, Ketosis, Lipid metabolic disorders (Lipidosis). Lipid Peroxidation and role of Antioxidants. Importance of Liposomes.

### **AMINOACIDS AND PROTEINS**

Classification and structures of  $\alpha$ -aminoacids found in proteins, Zwitterions and Isoelectric pH. Peptides of Biological activity like Glutathione, Insulin. Classification structure and bonds-maintaining structure of Proteins.

Functions of Plasma proteins. Structure function relationship with emphasis on Haemoglobin and Myoglobin. Basic concept of immunology, sStructure and Functions of Immunoglobin.

**METABOLISM:** Digestion and absorption of Proteins. General reactions of Aminoacids like oxidative and non-oxidative Deamination, Transamination, Decarboxylation and Transamidation. Transport and formation of Ammonia, Urea Cycle with inborn errors of metabolism. Catabolism including formation of specialized products and inborn errors of Glycine, Phenylalanine, tyrosine, tryptophan, Methionine, cysteine, Cystine and Histidine. Minor concept of metabolism of Branched Chain Aminoacids, Creatinine metabolism.

### **METABOLISM OF NUCLEIC ACIDS AND NUCLEOTIDES**

Structure of RNA and DNA (A, B & Z), Common derivatives of purine and pyrimidines. Basic concepts of nucleosides and nucleotides. Metabolism of Purines and Pyrimidines. Uric acid metabolism.

### **MOLECULAR BIOLOGY**

Definition of introns: Exons, Clone, Library, Genome, Plasmid, Fingerprinting, Footprinting, Vector, Probe, Hairpin. Ligation, Splicing, Western Blot, Northern Blot, Southern blot.

Replication, transcription, genetic code and Translation. Definition and Types of mutation: Point mutation, Frameshift mutations, Missense mutation. Gene Regulation on the basis of Lac Operon Concept. Concept of Recombinant DNA Technology. xdxChemical carcinogenesis.

### **MINERAL METABOLISM**

Biochemical role of minerals (Sodium, potassium, Magnesium, Fluorine, Calcium, Phosphorous, Iron, Iodine, Copper, Chloride, Zinc, Selenium). Common Clinical disorders associated with metabolism of these minerals.

Water and electrolyte balance an imbalance.

## **HEME METABOLISM**

Heme Catabolism, Heme Anabolism, Porphyrrias

## **ACID BASE BALANCE**

Definition pH and Buffers, Handerson Hasselbach Equation (excluding its derivation), Blood Buffers: Define Metabolic and Respiratory acidosis and Alkalosis along with common causes. Role of Lungs and Kidneys in pH maintenance.

## **ENDOCRINOLOGY (HORMONES)**

Classification and Mechanism of action of Hormones, Biosynthesis, Secretion and metabolic effects of Hormones of Adrenals, Thyroid, Parathyroid and Pancreatic gland and related disorders, Hormonal regulation of metabolism.

## **ORGAN FUNCTION TEST**

Thyroid Function Test: (Radioactive Iodine uptake, general concept of T3, T4 and TSH)

Liver Function Tests: General concept and Clinical importance of SGOT/SGPT, ALP, LDH, Gamma GT, total Protein, Albumin and AG Ratio. Direct and Indirect Bilirubin and Urinary Bile Salts and Bile Pigments.

Renal Function Tests: Significance of Clearance tests (Urea, Creatinine and Inulin).

Pancreatic Function Test; Gastric Function Test:

## **DETOXIFICATION**

Detoxification of Xenobiotics.

## **RADIO-ISOTOPES**

Diagnostic and therapeutic importance of radioisotopes (Iodine, phosphorus, Cobalt and technetium).

## **CHROMATOGRAPHY**

General concept of paper chromatography, TLC, HPLC and GLC.

## **ELECTROPHORESIS**

Definition and techniques (PAGE, Paper Electrophoresis and High Voltage Electrophoresis).

## DETAILED PRACTICAL SYLLABUS

1. Case study of interpretation of Laboratory data.
2. Qualitative analysis of Normal and Abnormal Constituents of urine (Sugar, Protein, Bile, Ketone bodies, Bile pigments, Blood) and interpretation of results of each analysis.
3. Principles of Colorimetry.
4. Qualitative Estimations:
  - i) Blood/Serum: Sugar, Urea, Creatinine, Bilirubin (Total and Conjugated), Total Protein, Albumin and AG Ratio, Cholesterol, Uric acid and interpretation of result.
  - ii) Urine: Estimation of Creatinine, Creatinine Clearance and interpretation of result.
  - iii) CSF: Estimation of Sugar, Proteins and Chlorides in CSF.
5. Demonstration of Enzyme estimation: SGOT, SGPT, ALP, Amylase and Interpretation of result.
6. Demonstration of Chromatography and the Electrophoresis Techniques and Interpretation of a Chromatography and the Electrophoresis Pattern of serum Proteins.
7. Demonstration of Spectroscopy of Haemoglobin and Derivatives.
8. Demonstration of Semi/Auto Analysers, Flame Photometer and pH Meters.

### Demonstration:

Introduction to some analytical techniques such as Photoelectric colorimetry, Flame photometry, Chromatography, Electrophoresis etc.

### Recommended Text Books:

1. Harper Illustrated Biochemistry. (29<sup>th</sup> Ed.)  
Robert K. Murray, David A. Bender, Kathleen M. Botham, Peter J. Kennelly, Victor W. Rodwell and P. Anthony.
2. Lippincott's Illustrated Reviews. (5<sup>th</sup> Ed.)  
Richard Harvey and Denise Ferrier.
3. Text Book of Biochemistry. (3<sup>rd</sup> Ed.)  
U. Satyanarayana and U. Chakrapani.
4. Text Book of Biochemistry. (7<sup>th</sup> Ed.)  
DM. Vashudevan, Sreekumari S and Kannan Vaidyanathan.

### Reference Text Books:

1. Text Book of Biochemistry with Clinical Correlations. (7<sup>th</sup> Ed.)  
Thoms M. Devlin
2. Lehninger Principles of Biochemistry. (6<sup>th</sup> Ed.)  
David L. Nelson and Michael M. Cox.

**Practical Work Book:**

1. Practical Text Book of Biochemistry for Medical students.  
DM Vasudevan and Subir Kumar Das.
2. Practical Biochemistry.  
Geetha Damodaran k.

**3. \*SUBJECT: PHYSIOLOGY**  
**Distribution of marks and syllabus**  
**THEORY:**

<b>PAPER-A:</b>	<b>Syllabus/ Topics</b>	<b>No. of Questions</b>
Part - I	General Physiology, Biophysics Nerve & Muscle Physiology And Nervous System.	Six questions (Three in each part) Each Part may have one long question & other as short note.
Part - II	Special senses, Endocrines, Reproduction including Growth and Sterility.	
<b>PAPER-B:</b>		
Part - I	Blood and Lymph, circulation, skin and Body Temperature.	
Part - II	Respiration, Digestion, Nutrition and Kidney (Excretion).	



## **Syllabus - Theory Physiology (U.G. students)**

### **General Physiology**

1. Homeostasis, milieu interieur, physiological norms, their range and control.
2. Structure and function of the cell and its organelles
3. Structure and functions of the cell membrane.
4. Mechanism and modes of transport across cell membrane
5. Intercellular communication,
6. Membrane receptors, second messengers and signal transduction.
7. Body fluid compartments and their measurements.
8. Fluid and electrolyte balance.

### **Blood**

1. Composition and functions of blood.
2. Functions of plasma proteins
3. Red blood cells-structure, function , RBC lifespan, Fragility
4. Classification and functions of leukocytes, Tissue Macrophage system
5. Haemoglobin,- structure, functions, types , Bilirubin metabolism, Jaundice
6. Haemopoiesis and factors regulating it, Erythropoiesis and its regulation.
7. Classification of anaemias and principles of management of anaemia due to deficiency of iron Vitamin B12, and folic acid.
8. Erythrocyte sedimentation rate and factors affecting it.
9. Types and mechanism of immunity. Complement system. AIDS
10. Structure and functions of platelets and their role in coagulation.
11. Hemostasis and its disorders.
12. Role of vascular endothelium in blood coagulation.
13. Anticlotting mechanisms. Anticoagulants and their mechanism of action.
14. Blood groups: ABO, Rh and MN systems, Clinical importance, Blood transfusion and blood banking .
15. Formation, composition and functions of lymph.

### **Nerve Muscle Physiology**

1. Structure of neuron and neuroglia.
2. Genesis of the resting membrane potential
3. Action Potential-generation and its ionic basis, properties, conduction of the nerve impulse, types
4. Graded potential
5. Compound action potential
6. CRO
7. Classification of nerve fibers.
8. Degeneration and regeneration of nerve fibers.

9. NM Junction-Structure and transmission across the neuromuscular junction. Drugs affecting neuro-muscular transmission. Disorders of the neuromuscular junction - Myasthenia Gravis.
10. Effects of denervation.
11. Skeletal muscle-Structure of macromere, Events in skeletal muscle contraction and relaxation. Types of skeletal muscle fibers. Motor units. EMG, Properties of skeletal. Length- tension relationship.
12. Smooth Muscle-Structure , Types ,Electrical activity ,Mechanism of contraction and relaxation of smooth muscle., Plasticity. Neural and chemical control of smooth muscle.
13. Cardiac Muscle-Structure , potentials of cardiac muscle .length – tension relationship of cardiac muscle.
14. Energy sources for muscle contraction.O<sub>2</sub> dept.

### Excretory System

1. Structure and functions of the of nephron and Juxtaglomerular apparatus.
2. Renal blood flow and its measurement and regulation.
3. Concepts of plasma clearance.
4. Glomerular filtration, measurement, and factors affecting GFR.
5. Reabsorption of essential nutrients: Glucose, sodium, potassium, calcium, phosphate, bicarbonate and water.
6. Secretion of substances like hydrogen and potassium. Excretion of metabolites.
7. Concentration of urine.
8. Mechanism of diuresis, and action of diuretics.
9. Role of kidney in fluid and electrolyte balance
10. Role of kidney in acid- base balance.
11. Innervation of bladder, Micturition, Cystometrogram and disorders of micturition. Atonic, autonomic and automatic bladder.
12. Non-excretory functions of the kidney.
13. Renal functions tests.
14. Renal failure,
15. Principles of dialysis.

### Digestive System

1. Functional anatomy of the gastrointestinal tract (G.I.T) structure and innervation of G.I.T.
2. Gastrointestinal hormones – gastrin, cholecystokinin – pancreozymin, secretin.
3. Gastrointestinal movements-Mastication, deglutition, Gastric motility, gastric emptying and vomiting.Motility of small intestine, large intestine, defecation.
4. Gastrointestinal secretions – salivary, gastric, pancreatic, biliary and intestinal secretions-formation and composition, their function in digestion, regulation of secretion.
5. Path physiology of diseases of the lower esophageal sphincter
6. peptic ulcer
7. jaundice,
8. Gall stones

9. Adynamic ileus,
10. Megacolon,
11. constipation,
12. diarrhoea
13. Digestion and absorption of carbohydrates, proteins and nucleic acids, electrolytes and water, lipids, vitamins, minerals, iron, calcium. Malabsorption syndrome.

### Endocrine System

1. General principles of regulation of endocrine gland secretions. Secretion, Chemical nature, mechanism of action, physiological actions and consequences of altered secretion of the hormones of the:
  - a. Hypothalamus
  - b. anterior pituitary
  - c. posterior pituitary
  - d. thyroid,
  - e. Parathyroid
  - f. adrenal cortex
  - g. adrenal medulla
  - h. endocrine pancreas
  - i. gonads.
2. Physiology of growth.
3. Role of hormones in stress.
4. Functions of thymus and pineal glands
5. Physiological actions of local hormones

### Male and Female Reproduction

1. Puberty-Control of onset of puberty. Pubertal changes in male and female.
2. Meno of pituitary gonadotropins and prolactin in males and females.
3. Male reproductive system-Functional anatomy of male internal and external genitalia . Blood- testes barrier. Spermatogenesis. Composition of semen. the male sexual act.Actions and regulation of testosterone, and Control of testicular function.
4. Female reproductive system-Functional anatomy of female internal and external genitalia. Cyclical changes in ovary, uterus, cervix, vagina and breast during menstrual cycle and hormonal regulation of the menstrual cycle. Chemical nature, actions and regulation of secretion of estrogen, progesterone. Indicators of ovulation. Common menstrual abnormalities.
5. Principles and methods of contraception in male and female.
6. Fertilization , implantation. Physiological changes in pregnancy and hormonal control of pregnancy.
7. Foetoplacental unit.
8. Physiology of parturition.
9. Hormonal control of breast development after puberty and during pregnancy.
10. Control of milk secretion and milk ejection, and effect of lactation on menstrual cycle.

11. Sex differentiation and development of genitalia in the embryo. Some examples of aberrant sex differentiation due to 1. Chromosomal abnormalities 2. Hormonal abnormalities. Composition of human milk and colostrum.

### Cardiovascular System.

1. Organization of cardiovascular system. Functional anatomy of heart and blood vessels.
2. Properties of cardiac muscle.
3. Action potentials recorded from different tissues of heart.
4. Origin and spread of cardiac impulse.
5. **Normal ECG:** methods of recording, mechanism of production of different ECG waves in different leads. Physiologic basis of ECG, ECG abnormalities in common cardiac diseases and in electrolyte disturbances.
6. **Cardiac cycle:** Mechanical events, Heart sounds. Jugular venous pulse, arterial pulse.
7. Cardiac output: definition, physiological variations, principles of measurement and regulation.
8. Heart rate: Regulation, normal value and physiological variations.
9. **Principles of hemodynamics.**
10. Arterial, arteriolar, venous and capillary circulation.
11. **Blood pressure:** definition, types, variations and methods of measurement.
12. Integrated regulation of cardiovascular system.
13. **Regional circulation:** cerebral, coronary, cutaneous, visceral, muscle and fetal circulation.
14. Pathophysiology of hypertension
15. heart failure
16. shock and the physiologic basis of their management.
17. Cardiac function tests
18. Cardiopulmonary resuscitation.
19. Cardiovascular changes during: 1. Change in posture 2. Muscular exercise.

### Respiration.

1. Functional anatomy of respiratory system.
2. Mechanics of respiration.
3. Surfactant, Compliance.
4. Lung volumes and capacities.
5. Pulmonary function tests.
6. Pulmonary circulation, normal values and regulation.
7. Content and partial pressure of oxygen and carbon dioxide in inspired air, expired air, alveolar air, arterial blood and venous blood.
8. Diffusion of gases in lungs and factors affecting it. Ventilation – perfusion ratio.
9. Anatomical and physiological dead space and their significance.
10. Oxygen and carbon dioxide transport, oxygen hemoglobin dissociation curve, and factors affecting it.
11. Neural, reflex and chemical regulation of respiration.
12. Types of hypoxia and physiological basis of their classification.

13. . Oxygen therapy and hyperbaric oxygen.
14. Pathophysiology of common respiratory disorders.
15. Periodic breathing
16. respiratory adjustments during breath holding, hyperventilation, muscular exercise, cyanosis, hypercapnea, hypocapnea, asphyxia, high altitude.
17. Work of breathing.
18. Non-respiratory functions of the lung.

### **Central Nervous System.**

1. Organization and functional anatomy of central nervous system.
2. Neuronal organization and function at the levels of spinal cord.
3. Synaptic transmission.
4. Reflexes, muscle spindle
5. regulation of muscle tone
6. Sensory receptors and initiation of impulses in sense organs and ascending sensory pathways for different sensory modalities.
7. Physiology of pain.
8. Nuclei and functions of thalamus.
9. Brain stem reticular system. Sleep, wakefulness, and EEG.
10. Organization of motor system. Descending tracts, corticospinal tract, and effects of lesions at different levels.
11. Functional anatomy, physiology, and functions of basal ganglia, cerebellum and vestibular apparatus.
12. Effects of clinical and experimental lesions at various levels of neural axis.
13. Nuclei of hypothalamus and their functions.
14. Regulation of body temperature.
15. Limbic system, connections, and physiological functions.
16. Functional areas of cerebral cortex.
17. Higher functions-Conditioned reflexes, learning, memory and speech and its disorders.
18. Formation, circulation and functions of CSF.
19. Concept of blood- brain-barrier.

### **Autonomic Nervous System**

1. Organization and functions autonomic nervous system.
2. Facilitatory and inhibitory neurotransmitters.

### **Special Senses**

1. Eye-Functional anatomy of the eyeball. Intra – ocular tension. Structure and functions of retina. Visual pathways and effect of lesion at various levels. Role of visual cortex in vision. Principles of optics. Role of various refractory media in image formation. Errors of refraction. Mechanism of accommodation. Light reflex and the Near response. Rod and cone pigments and sequence of events in phototransduction. Dark adaptation. Visual acuity. Field of vision. Colour vision and its theories. Colour blindness and its inheritance. Eye movements. Electroretinogram.

2. **Hearing** Functional anatomy of external, middle and internal ear. Functions of external, middle and inner ear. Auditory pathways. Electrical responses in hair cells and genesis of action potentials in afferent nerve fibers. Mechanism of hearing. Sound waves, their pitch and loudness. Sound transmission and theories of hearing. Tympanic reflex, and masking. Role of auditory cortex in hearing. Sound localization. Types of deafness. Tests for hearing.
3. **Smell**-Receptors and pathways for smell. Cortical and limbic areas associated with smell. Physiology of olfaction. Odor discrimination. Abnormalities of olfaction.
4. **Taste**-Receptors and pathways for taste. Basic taste modalities and receptor stimulation. Taste threshold and intensity discrimination. Flavor. Substances evoking primary taste sensations. Abnormalities of taste

### **Course Content - Practical**

The following list of experiments and demonstrations is not exhaustive. Additional experiments can be included as and when feasible and required.

### **Haematology**

#### **Practicals**

1. Principles of microscopy and use of microscope.
2. Total red cell count
3. Estimation of hemoglobin and calculation of blood indices.
4. Total leucocyte count
5. E.S.R & P.C.V
6. Preparation and staining of a blood smear
7. Performing differential leucocyte count and Arneeth count
8. Absolute eosinophil count
9. Bleeding time and clotting time
10. Blood grouping – ABO & Rh

#### **Demonstrations**

1. Methods of collection of blood
2. Reticulocyte count
3. Platelet count.
4. Osmotic fragility of red cells
5. specific gravity

### **Nerve and Muscle**

#### **Practicals**

1. Mořso's ergography: Calculation of work done and effect of rate of work done on muscle fatigue.
2. Calculation of mechanical efficiency by i) bicycle ergometry

### **Demonstrations and interpretation of graphs by simulations.**

1. Study of appliances used in amphibian practicals.
2. Recording of muscle twitch and calculation of velocity of nerve impulse in the frog  
Gastrocnemius – sciatic preparation.
3. Demonstration of phenomenon and site of fatigue in gastrocnemius – sciatic preparation of frog.
4. Electromyography and nerve conduction in humans.
5. Strength – Duration curve.
6. Effect of ions and drugs on small intestine of rabbit.

### **CVS**

#### **Practicals**

1. Recording and examination of pulse.
2. Measurement of blood pressure.
3. Effect of posture and exercise on Blood pressure and heart rate.
4. ECG recording.
5. Clinical examination of CVS
6. Cardiac efficiency tests by Harvard step test.

#### **Demonstrations**

1. Effect of drugs and ions on frog heart.
2. Effect of vagal stimulation on frog heart.
3. Properties of Cardiac muscle.

### **Respiration**

#### **Practicals**

1. Clinical examination of respiratory system.
2. Pulmonary function tests including spirometry.
3. Stethography.

### **Nervous system**

#### **Practicals**

1. Examination of sensory functions
2. Examination of motor functions.
3. Examination of cranial nerves.
4. Examination of superficial and deep reflexes.
5. Examination of higher function tests.
6. Cerebellar function tests.

### **Demonstrations**

1. EEG
2. Evoked potentials
  - a. Brain stem evoked potential
  - b. Visual evoked potential

### **Special senses**

#### **Practicals**

1. Acuity of vision
2. Colour vision
3. Perimetry
4. Tests for hearing.(auditory function tests)