DPU

Dr. D. Y. PATIL VIDYAPEETH, PUNE
(Deemed to be University)

Regulations and Syllabus for I – MBBS (Pre - Clinical Subjects)

2014 - 15
(Amended / Revised upto July 2019)

DPU

Dr. D.Y. PATIL VIDYAPEETH, PUNE
(Deemed to be University)
(Re-accredited by NAAC with a CGPA of 3.62 on a four point scale at 'A' Grade)
(An ISO 9001 : 2015 Certified University)

Dr. A. N. Suryakar
Registrar

Ref. No. : DPU/875-VII/2019
Date : 11/09/2019

NOTIFICATION

Whereas in pursuance of the following decisions taken by the Board of Management, it is hereby notified to all concerned that the **"Syllabus for I-M.B.B.S. (Pre-Clinical Subjects) – 2014-15"** is **revised upto July 2019** and hereby published.

- Changes in syllabus for UG and PG in Anatomy, Biochemistry, Community Medicine, vide **Resolution No. BM-07-(iii)-4 dated 28th January, 2014.**
- Updation in UG syllabus of Biochemistry vide **Resolution No. BM-04(i)-15, dated 31st March, 2015.**
- Adoption of **"Double Evaluation System"** for UG Answer Papers **vide Resolution No. BM-07-15 dated 31st March, 2015.**
- Inclusion of one lecture on Physiology of Yoga and two lectures on Sports Physiology in the Physiology subject, **vide Resolution No. BM-26(ii)-15, dated 29th December, 2015.**
- Introduction of Bioethical aspects in various chapters of all subjects vide **Resolution No. BM-26(xi)-15, dated 29th December, 2015.**
- Modifications in I MBBS University Practical Examinations schedule vide **Resolution No. BM-17(i)-16, dated 22nd September, 2016.**
- Inclusion of Curriculum of Bioethics in UG Anatomy, Physiology and Biochemistry subjects **vide Resolution No. BM-17(viii)-16, dated 22nd September, 2016.**
- Introduction of Sectional Anatomy and Sonographic Anatomy, an Integrated approach towards Radiology and Imaging Sciences in first year in the Subject of Anatomy UG curriculum, **vide Resolution No. BM-20(ii)-17, dated 29th July, 2017.**
- Inclusion of Lectures in Aviation and Space Physiology in Physiology subject of the first year MBBS curriculum vide **Resolution No. BM-20(iii)-17, dated 29th July, 2017.**
- Inclusion of theory lectures in cross sectional and ultrasound anatomy in the syllabus of first year of MBBS curriculum vide **Resolution No.BM-38(i)-17, dated 27th December, 2017.**
- Introduction of one of the questions as MCQ test in continues assessment examinations in Pre-Clinical subjects vide **Resolution No.BM-38(ii)-17, dated 27th December, 2017.**
- To replace spotting in Anatomy practical examination of UG examinations by clinical work stations like objective structured practical examination **vide Resolution No. BM-38(iii)-17, dated 27th December, 2017.**
- Introduction of surface anatomy on mummified bodies along with living anatomy in Anatomy practical examinations **vide Resolution No. BM-38(v)-17, dated 27th December, 2017.**
- Inclusion of a lecture on study and practice of Yoga on 2nd and 4th Saturday of every month for First Year MBBS students, **vide Resolution No. BM-38(vi)-17, dated 27th December, 2017.**

Dr.D.Y.PATIL VIDYAPEETH PIMPRI, PUNE-18.

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- Changes in the syllabus of Ist year MBBS practical examinations of Biochemistry subject **vide Resolution No. BM-35(i)-18, dated 12th October, 2018.**
- Implementation of competency based curriculum for first year MBBS students as per guidelines of MCI **vide Resolution No.BM-10(i)-19, dated 12th April, 2019.**
- Interdisciplinary subjects of M.B.B.S, M.D./M.S. and Super-specialty (D.M./M.Ch.) Programs under the Faculty of Medicine **vide Resolution No. BM-10(viii) dated 12th April, 2019.**
- University Practical Examination Patten as per Competency Based Medical Education (**CBME**) curriculum of MCI vide Resolution **No. BM-27(i)-19, dated 30th July, 2019.**
- Graduate Attributes, Programme Outcomes (POs), Course Outcomes (Cos) outcome analysis of POs and COs and mapping with objectives for all courses of UG and PG Programmes of Pre-Clinical and Medicine Subjects under the Faculty of Medicine **vide Resolution No. BM-27(x)-19 dated 30th July, 2019.**
- Interdisciplinary subjects of M.B.B.S, M.D./M.S. and Super-specialty (D.M./M.Ch.) Programs under the Faculty of Medicine **vide Resolution No. BM-27(xi) dated 30th July, 2019.**

The **Syllabus for I-M.B.B.S. (Pre-Clinical Subjects) – 2014-15 Revised upto July 2019** will be useful to all the concerned. This will come into force with immediate effect.

Dr. D. Y. PATIL VIDYAPEETH PIMPRI, PUNE-18. Deemed to be University

(Dr. A. N. Suryakar)
Registrar

Copy to:

1. PS to Chancellor for kind information of Hon'ble Chancellor, Dr. D. Y. Patil Vidyapeeth, Pune.
2. PS to Vice Chancellor for kind information of Hon'ble Vice Chancellor, Dr. D. Y. Patil Vidyapeeth, Pune.
3. The Dean, Dr. D. Y. Patil Medical College Hospital & Research Centre, Pimpri, Pune
4. The Controller of Examinations, Dr. D. Y. Patil Vidyapeeth, Pune.
5. Director (IQAC), Dr. D. Y. Patil Vidyapeeth, Pune.
6. Web Master for uploading on Website.

REGULATIONS AND SYLLABUS FOR M.B.B.S. DEGREE COURSE

1. SHORT TITLE AND COMMENCEMENT

These regulations may be called "The Regulations for the Bachelor of Medicine and Bachelor of Surgery Degree Course of Dr. D. Y. Patil Vidyapeeth, Pune (Deemed to be University)

These regulations shall come into force from the academic year 1997 - 1998 and amendments notified by MCI from time to time.

2. ELIGIBILITY FOR ADMISSION TO M.B.B.S

DEGREE COURSE QUALIFICATION FOR ADMISSION:

No candidate shall be allowed to be admitted to the first year Bachelor of Medicine and Bachelor of Surgery (MBBS) Course until:

He/She has completed the age of 17 years on or before 31st December of the year of admission to the MBBS course.

He / She has passed qualifying examination as under :-

(a) The higher secondary examination or the Indian School Certificate Examination which is equivalent to 10+2 Higher Secondary Examination after a period of 12 years study, the last two years of study comprising of **Physics, Chemistry, Biology / Bio-technology** and Mathematics or any other elective subjects with English at a level not less than core course of English as prescribed by the National Council of Educational Research and Training after the introduction of the 10+2+3 years educational structure as recommended by the National Committee of education;

Note: Where the course content is not as prescribed for 10+2 education structure of the National Committee, the candidates will have to undergo a period of one year pre-professional training before admission to the Medical colleges;
Or

(b) The intermediate examination in science of an Indian University / Board or other recognised examining body with **Physics, Chemistry and Biology / Bio-technology** which shall include a practical test in these subjects and also English as a compulsory subject;

Or

(c) The pre-professional/pre-medical examination with Physics, Chemistry and Biology/Bio-technology, after passing either the higher secondary school examination, or the pre-university or an equivalent Examination. The pre-professional/pre-medical examination shall include a practical test in **Physics, Chemistry and Biology / Bio-technology** and also English as a compulsory subject;
Or

(d) The first year of the three years degree course of a recognized university, with Physics, Chemistry and Biology including a practical test in these subjects provided the examination is a "University Examination" and candidate has passed 10+2 with English at a level not less than a core course;
Or

(e) B.Sc examination of an Indian University, provided that he/she has passed the B.Sc examination with not less than two of the following subjects Physics, Chemistry, Biology (Botany, Zoology) and further that he/she has passed the earlier qualifying examination with the following subjects - Physics, Chemistry, Biology and English.
Or

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

3. PROCEDURE FOR SELECTION TO MBBS COURSE

1] There shall be a uniform entrance examination to all medical educational institutions at the undergraduate level namely 'National Eligibility-cum-Entrance Test for admission to MBBS course in each academic year and shall be conducted under overall supervision of the Ministry of Health & Family Welfare, Government of India.

2] The "designated authority" to conduct the 'National Eligibility-Cum-Entrance Test' shall be the Central Board of Secondary Education or any other body/organization so designated by the Ministry of Health & Family Welfare, Government of India, in consultation with the Medical Council of India.

3] The language and manner of conducting the 'National Eligibility-Cum-Entrance Test' shall be determined by the "designated authority" in consultation with the Medical Council of India and the Ministry of Health and Family Welfare, Government of India.

4] In order to be eligible for admission to MBBS Course for a academic year, it shall be necessary for a candidate to obtain minimum of marks at 50th percentile in 'National Eligibility-cum-Entrance Test to MBBS course' held for the said academic year. However, in respect of candidates belonging to Scheduled Castes, Scheduled Tribes, Other Backward Classes, the minimum marks shall be at 40th percentile. In respect of candidates with benchmark disabilities specified under the Rights of Persons with Disabilities Act, 2016, in terms of Clause 4(3) above, the minimum marks shall be at 45th percentile. The percentile shall be determined on the basis of highest marks secured in the All-India common merit list for admission in 'National Eligibility-cum-Entrance Test for admission to MBBS course.

Provided when sufficient number of candidates in the respective categories fail to secure minimum marks as prescribed in National Eligibility-cum-Entrance Test held for any academic year for admission to MBBS Course, the Central Government in consultation with Medical Council of India may at its discretion lower the minimum marks required for admission to MBBS Course for candidates belonging to respective categories and marks so lowered by the Central Government shall be applicable for the said academic year only.

4. REGISTRATION/ Eligibility Certificate

A candidate admitted to the course shall register with this University by remitting the prescribed fees along with the prescribed application form for registration duly filled in, within the stipulated date.

5. DURATION OF THECOURSE

The period of certified study and training for the course of Degree of Bachelor of Medicine and Bachelor of Surgery shall extend over a period of four and half academic years and one year of Compulsory Rotatory Resident Internship before the award of the Degree.

6. CURRICULUM

The curriculum and the syllabus for the course shall be as prescribed from time to time by the appropriate bodies.

COMMENCEMENT OF THECOURSE

The first year MBBS Course shall begin on or before 1st August of every academic year.

7. TRAINING PERIOD AND TIME DISTRIBUTION

(a) Every student shall undergo a period of certified study extending over four and half academic years divided into 9 semesters, (i.e. of 6 months each) from the date of commencement of study for the subjects comprising the medical curriculum to the date of completion of examination and followed by one year Compulsory Rotatory Residential Internship. Each semester will consist of approximately 120 teaching days of 8 hours duration including one hour for lunch.

(b) The period of four and half years is divided into three phases as follows:

- Phase - I (two semesters) consisting of pre-clinical subjects (Anatomy, Physiology, Biochemistry and introduction to Community Medicine including Humanities). Sixty hours are allocated for introduction to Community Medicine including Humanities, and rest of the time shall be and again divided between Anatomy and Physiology (2/3) plus Biochemistry (1/3)combined.

- Phase - II (three semesters) consisting of para-clinical / clinical subjects.

  During this phase teaching of para-clinical and clinical subjects shall be done concurrently.

  The para-clinical subjects shall consist of Pathology, Pharmacology, Microbiology, Forensic Medicine including Toxicology and part of Community Medicine.

  The clinical subjects shall consist of all those detailed below in Phase III.

  Out of the allotted time for para-clinical teaching, approximately equal time be allotted to Pathology, Pharmacology, Microbiology and Forensic Medicine, Community Medicine combined (1/3 for Forensic Medicine and 2/3 for Community Medicine).

- Phase - III (four semesters) 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.

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

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

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

(e) Supplementary examination will be conducted as follows:
Supplementary examination may be conducted within 3 months so that the students who pass can join the main batch and the failed students will have to appear in the subsequent year.

8. PHASE DISTRIBUTION AND TRAINING OFEXAMINATIONS:

6 Months	6 Months	6 Months	
1	2		I[st] Professional examination (during 2[nd]semester)
3	4	5	II[nd] Professional examination (during 5[th] semester)
6	7		III[rd] Professional Part I examination (during 7[th] semester)
8	9		III[rd] Professional Part II (Final Professional) (during 9[th] semester)

(a) Passing in I[st] Professional examination is compulsory before proceeding to Phase II training.

(b) A student who fails in the II[nd] Professional examination, shall not be allowed to appear for III[rd] Professional Part I examination unless he/she passes all subjects of II[nd] Professional examination.

(c) Passing in III[rd] Professional (Part I) is compulsory for being eligible for III[rd] Professional (Part II) examination.

During third to ninth semesters, clinical postings of three hours duration daily as specified is suggested for various departments, after introductory course in Clinical Methods in Medicine and Surgery of two weeks each for the whole class.

9. ACADEMICTERMS

First M.B.B.S
Part-I & Part II - 1[st] August to June 15[th]

10. CUT OFFDATES

As decided by the appropriate bodies from time to time.

11. EXAMINATIONDATE

There shall be two sessions of University examinations in an academic year, viz., June and December.

12. WORKING DAYS IN AN ACADEMICYEAR

Each academic year shall consist of not less than 240 working days.

13. ATTENDANCE REQUIRED FOR ADMISSION TO EXAMINATION

(a) No candidate shall be permitted to any one of the parts of MBBS Examinations unless he/she attended the course in the subject for the prescribed period and produces the necessary certificate of study, attendance and progress from the Head of the Institution.

(b) A candidate is required to put in minimum 75% of attendance in a subject for appearing in the examination, inclusive of attendance in non-lectures teaching, i.e. seminars, group discussions, tutorials, demonstrations, practicals, Hospital (Tertiary, Secondary, Primary) postings and bed side clinics, etc.

(c) A candidate lacking in the prescribed attendance and progress in any one subject in theory and practical / clinical in the first appearance shall not be permitted for admission to the university examination in that subject only.

14. MIGRATION/TRANSFER OF CANDIDATES

The Medical Council of India Regulations relating to Migration will be followed by the University as reproduced below:

(1) Migration of students from one medical college to another medical college may be granted on any genuine ground subject to the availability of vacancy in the college where migration is sought and fulfilling the other requirements laid down in the Regulations. Migration would be restricted to 5% of the sanctioned intake of the college during the year. No migration will be permitted on any ground from one medical college to another located within the same city.

(2) Migration of students from one College to another is permissible only if both the colleges are recognized 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 Certificate" from the college where he is studying for the present and the university to which that college is affiliated and also from the college to which the migration is sought and the university to it that college is affiliated. He / She shall submit his application for migration within a period of 1 month of passing (Declaration of result of the 1st Professional MBBS examination) along with the above cited four "No Objection Certificates" to: (a) the Director of Medical Education of the State, if migration is sought from one college to another within the same State **or** (b) the Medical Council of India, if the migration is sought from one college to another located outside the State.

(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."

15. SUBMISSION OF LABORATORY RECORD NOTEBOOKS

At the time of practical/clinical examination, each candidate shall submit to the Examiners his/her laboratory notebooks duly certified by the Head of the Department as a bonafide record of work done by the candidate. The practical record shall be evaluated by the Head of the Department.

The candidate may be permitted by the Examiners to refer to the practical record book during the practical examination in the subject of Biochemistry only. No other material, handwritten, cyclostyled or printed guides is allowed for reference during the practical examinations.

In respect of failed candidates, the marks awarded for records at previous examinations will be carried over for the subsequent examination or the candidates shall have the option to improve his performance by submission of fresh records.

16. INTERNAL ASSESSMENT

1] A minimum of three written and practical examinations shall be conducted in each subject during an academic year and the average marks of three best performances shall be taken into consideration for the award of sessional marks.

2] Day to day records and logbook (including required skill certifications) should be given importance in internal assessment. Internal assessment should be based on skills and competencies. Students must have completed the required certifiable competencies and completed logbook appropriate for each phase of training to be eligible for appearing at the final university examination of that subject.

3] Learner must secure at least 50% marks of total marks (combined in theory / Practical, not less than 40% 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 the subject. Internal assessment marks will not be added to university examination and reflected as a separate head of passing at the summative examination.

4] The results of Internal Assessment should be displayed on notice board within 1-2 weeks of the test. Formulate remedial measures for students who are either not able to score qualifying marks or have missed some assessment due to any reason by forming committee under the Chairmanship of Dean, Dr. D. Y. Patil Medical College, Hospital and Research Center, Pune and three more members.

There shall be one additional examination after third internal assessment (Prelim) examination as per recommendation by institutional grievance committee before the submission of IA marks sheet to University.

17. CLASSIFICATION OF SUCCESSFULCANDIDATES

A successful candidate

i. Who secures not less than 75% in the aggregate marks shall be declared to have secured, **FIRST CLASS WITH DISTINCTION'** provided he/she passes the whole examination in the FIRSTATTEMPT;

ii. Who secures not less than 65% in the aggregate marks and completes the course within the stipulated course period shall be declared to have passed the examinations in the **'FIRSTCLASS'**;

iii. Who secures above 50% marks and completes the course within the stipulated course period shall be declared to have **PASSED** the examinations

18. EXEMPTION FROM RE-EXAMINATION IN ASUBJECT

Where a candidate obtains pass marks in a subject (or) subjects but fails in other subject (s) he / she shall be exempted from reexamination in the subject (s) he / she has passed.

MAPPING OF PROGRAMME OUTCOMES [POs] AND COURSE OUTCOMES [COs] OF MBBS PROGRAMMES

Programme Outcomes	
Programme Name: MBBS	
Programme Code: MB	
Sr.No.	**By the end of the programme, the MBBS Graduate will have /be:**
PO 1	Knowledge and Skills
PO 2	Planning and Problem-solving abilities
PO 3	Communication
PO 4	Research Aptitude
PO 5	Professionalism and Ethics
PO 6	Leadership
PO 7	Societal Responsibilities
PO 8	Environment and Sustainability
PO 9	Lifelong Learner

Course Outcomes and Mapping with Programme Outcomes	
Year I	
Course Code	**Course Title**
MB101	Human Anatomy
MB102	Human Physiology
MB103	Human Biochemistry

Human Biochemistry (MB103)		
CO No.	**At the end of the course, the learner should be able to:**	**Mapped Programme Outcomes**
MB103.1	Describe the molecular and functional organization of a cell and list its subcellular components.	PO1, PO3, PO4, PO5, PO6, PO7, PO9
MB103.2	Delineate structure, function and inter-relationships of biomolecules and consequences of deviation from normal.	PO1,PO5,PO7,PO9
MB103.3	Summarize the fundamental aspects of enzymology and its clinicalapplication. Describe enzyme inhibitors as poisons and drugs and as therapeutic enzyme.	PO1, PO2, PO4, PO5,PO7,PO9
MB103.4	Describe digestion and assimilation of nutrients and consequences of malnutrition.	PO1,PO3,PO5,PO7
MB103.5	Integrate the various aspects of metabolism and their regulatory pathway with structure and function of human body in health & disease.	PO1,PO5, PO7,PO9
MB103.6	Explain the biochemical basis of inherited disorders with their associated sequelae.	PO1,PO3, PO4,PO5, PO7,PO9
MB103.7	Describe mechanisms involved in maintenance of body fluid and pH homeostasis.	PO1,PO2, PO5, PO7,PO9
MB103.8	Outline the molecular mechanisms of gene expression and regulation; the principles of genetic engineering and their application in medicine	PO1,PO2,PO4, PO5,PO7,PO9
MB103.9	Summarize the molecular concept of body defences and their application in medicine.	PO1,PO4, PO5, PO7,PO8, PO9
MB103.10	Make use of conventional techniques / instruments to perform MB103chemical analysis relevant to clinical screening and diagnosis.	PO1,PO2, PO4,PO5, PO7,PO9
MB103.11	Analyze and interpret investigative data	PO1, PO2 PO3,PO5, PO6,PO7,PO9

Human Biochemistry (MB103)		
CO No.	**At the end of the course, the learner should be able to:**	**Mapped Programme Outcomes**
MB103.12	Demonstrate the skills of solving scientific and clinical problems and decision making	PO1, PO2 PO3,PO4,PO5, PO6,PO7,PO9

BIOCHEMISTRY

HUMAN BIOCHEMISTRY

Total no. of teaching hours allotted to Human Biochemistry – 240 hrs.

1.1 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.

1.2 OBJECTIVES:-

1.2.1 Knowledge –

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

- Describe the molecular and functional organization of a cell and list its subcellular components;
- Delineate structure, function &inter-relationships of biomolecules & consequences of deviation from normal;
- Summarize the fundamental aspects of enzymology and clinical application wherein regulation of enzymatic activity is altered;
- Describe digestion and assimilation of nutrients and consequences of malnutrition;
- Integrate the various aspects of metabolism and their regulatory pathways;
- Explain the biochemical basis of inherited disorders with their associated sequelae;
- Describe mechanisms involved in maintenance of body fluid and pH, homeostasis;
- Outline the molecular mechanisms of gene expression and regulation; the principles of genetic engineering and their application in medicine;
- Summarize the molecular concept of body defenses and their application in medicine;
- Outline the biochemical basis of environmental health hazards, biochemical basis of cancer and carcinogenesis;

- Familiarize with the principles of various conventional and specialized laboratory investigations and instrumentation analysis and interpretation of given data;
- Suggest experiments to support theoretical concepts and clinical diagnosis.

1.2.2 SKILLS :

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

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

1.2.3 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.

1.3 DETAILS OF SYLLABUS FOR HUMAN BIOCHEMISTRY.

1.3.1 Theory (Structural formulae are not obligatory)

- Introduction of Biochemistry as a basic science for the study of medicine, it's importance in clinical practice.
- Molecular and functional organization of a cell and its subcellular components, sub cellular fractionation by preparative ultra-centrifugation and importance of analysis.
- **Chemistry of carbohydrates:** Classification and biochemical importance, chemistry and functions of monosaccharides (excluding isomerism), disaccharides and polysaccharides including Glycosaminoglycans (mucopolysaccharides).
- **Chemistry of Lipids:** classification of lipids and biological importance of triacyl glycerol, phospholipids, glycolipids, fatty acids (PUFA), cholesterol, prostaglandin, steroids and lipoproteins.

- **Chemistry of proteins:** general nature of amino acids, various ways of classification of amino acids, biologically important peptides, classification, properties and biological importance of proteins. Structural organization of proteins and its importance, Plasma proteins-functions, clinical significance of various fractions, methods of separation (only principle). Acute phase reactants and their applications.

- **Enzymes:** General nature, classification of enzymes, specificity and mode of action of enzymes, mechanism of action- different models. Factors affecting enzymes activity. Enzymes inhibitions(Kinetics not expected). Clinical importance (Diagnostic, therapeutic & as a Laboratory reagent) of enzymes & isoenzymes.

- **Biological oxidation:** General concept of oxidation and reduction. Role of enzymes and co-enzymes. Electron transport chain. Enzyme complexes, substrate level and Oxidative phosphorylation, Role of uncouplers and inhibitors.

- **Hemoglobin:** Chemistry and functions of hemoglobin. Types of normal and abnormal hemoglobins (HbS, M, Thalassemia). Hemoglobin derivatives.

- **Hemoglobin Metabolism:** Synthesis and break down of hemoglobin, porphyrias (in brief), Fate of bilirubin, different types of Jaundice.

- **Vitamins:** General nature, classification, sources, active forms and metabolic role, deficiency manifestations, daily requirement and hypervitaminosis.

- **Nutrition:** Balanced diet for normal adult, Quality of dietary protein, Nutritional quality of proteins, chemical score and reference protein, BMR, SDA, protein energy malnutrition (Kwashiorkor and Marasmus), obesity.

- **Carbohydrate Metabolism:** Biochemical aspects of digestion and absorption of carbohydrates. Glycolysis, Rapoport Luebering cycle, Citric acid cycle, Gluconeogenesis, HMP shunt pathway and its biological significance, Synthesis and break down of glycogen, Uronic acid pathway (significance only). Metabolism of Galactose and Galactosemia. Blood sugar level and its regulation, oral GTT and glycosuria, Biochemistry of diabetes mellitus, manifestation and complications.

- **Protein Metabolism:** Bio-chemical aspects of digestion and absorption of proteins. Nitrogen balance. Fate of amino acid in the body, General catabolic reactions, Fates of ammonia (Urea cycle, glutamine formation), Metabolism of glycine, aromatic and sulphur containing amino acids and their inborn errors.

- **Lipid Metabolism:** Bio-chemical aspects of digestion and absorption of Lipids. Oxidation, biosynthesis of saturated fatty acids only, cholesterol biosynthesis, transport (role of HDL * LDL), excretion. Ketogenesis, Ketolysis and Ketosis. Adipose tissue metabolism, Lipolysis and re-esterification, fatty liver, lipotropic factors and atherosclerosis.

- **Chemistry and Metabolism of purines and pyrimidines:** nucleosides, nucleotides. Biologically important free nucleotides, Biosynthesis of purines (sources of ring and regulatory steps only, conversion of IMP to GMP and AMP) and salvage pathway, Biosynthesis of pyrimidines. Breakdown of purines and pyrimidines, regulation of purine and pyrimidine metabolism. Gout, Lesch - Nyhan Syndrome,

- Metabolic interrelationship of carbohydrates, lipids and proteins metabolism and metabolic changes during starvation.

- **Hormones:** General characteristics, classification & Mechanism of hormone action. cAMP the second messengers, phospho-tidyl inositol / calcium/ calmodulin system as second messengers.

- **Chemistry of nucleic acids:** Structure and function of DNA and RNA.

- **Molecular Biology:** Genetic code, DNA Replication, fidelity, conservation of genome, types of mutations. Transcription, Translation, chain initiation, chain elongation, chain termination, Inhibitors of protein biosynthesis. Molecular Mechanism of gene expression and regulation, Lac-operon model. Recombinant DNA, Restriction endonuclease, chimeric molecule and Gene library. Applications of recombinant DNA technology in relation to medicine, PCR and its applications.

- **Mineral Metabolism:** Study of (i) Calcium and phosphorous (ii) magnesium (iii) copper, iodine, iron, manganese, selenium, zinc and fluoride. Their importance in body in brief.
- Water and electrolyte (sodium, potassium and chloride) balance and imbalance including laboratory investigations.
- Acid base balance and imbalance, anion gap, laboratory investigations.
- **Function tests:**
  (i) Liver function tests,
  (ii) Kidney function tests and
  (iii) Thyroid function tests.
- **Detoxification mechanisms :** Bio-transformation phase-I hydrolysis, oxidation, reduction, phase-II conjugation.
- **Molecular concept of body defense and their application:**
  - Immunoglobulin- structure and functions.
  - Free radicals, enzymatic and nonenzymatic antioxidants.
- **Radioisotopes:** Uses of radioisotopes (therapeutic, diagnostic) and radiation hazards.
- **Environmental Biochemistry:** Definition, chemical stress, air and water-pollution, effects of temperature.
- **Biochemistry of cancer:** carcinogens, and outline mechanism of carcinogenesis, tumour markers, metastasis.
- **Tissue proteins in health and disease**: Collagen, muscle proteins, elastin, fibronectin, laminin, keratin, lens proteins, prion proteins.
- **Lectures : Curriculum of Bioethics (2 topics in 6 Hours)**
  i. What is ethics, medical ethics and bioethics
  ii. Historical perspectives of medical ethics
- **Language and Skills**

1.3.2 PRACTICAL

EXPERIMENTS:

1) Tests for monosaccharides.
2) Tests for disaccharides.
3) Colour reactions of proteins.
4) Precipitation reactions of proteins.
5) Estimation of blood sugar.
6) Estimation of blood urea.
7) Estimation of i) Serum creatinine, ii) Creatinine in urine.
8) Determination of serum total protein and albumin
9) Estimation of total and direct serum bilirubin.
10) Estimation of serum cholesterol.
11) Estimation of serum calcium.
12) Estimation of serum phosphorous (Inorganic)
13) Estimation of S.G.P.T./ALT.
14) Estimation of S.G.O.T./AST.
15) Estimation of serum alkaline phosphatase. (ALP)
16) Estimation of serum acid phosphatase.
17) Urine report; Physical characteristics and abnormal constituents.
18) C.S.F.- Sugar and Protein.
19) Serum uric acid.

LECTURE – CUM – DEMONSTRATIONS:

1. pH – measurement and Blood Gas Analysis
2. Colorimetry
3. Electrophoresis.
4. Chromatography.
5. ELISA
6. Automation in clinical biochemistry
7. Laboratory investigations for Jaundice and Diabetes Mellitus
8. Laboratory investigations of Acute Myocardial Infarction
9. **Electrolyte analysis by Ion selective electrode (ISE) technique**
   The journal should be scrutinized by the teacher concerned and presented during university examination.

1.4 TOPICS OF THE LECTURES AND APPROXIMATE NUMBER OF LECTURES:

1.	Introduction to Biochemistry.	1
2.	Chemistry of Carbohydrates.	5
3.	Chemistry of Proteins	6
4.	Chemistry of Lipids	4
5.	Enzymes	6
6.	Biological oxidation	3
7.	Chemistry and functions of Haemoglobin and abnormal haemoglobins	3
8.	Haemoglobin metabolism.	2
9.	Carbohydrate metabolism	6
10.	Protein Metabolism	7
11.	Lipid Metabolism	6
12.	Integration of metabolism and metabolic changes during starvation	2
13.	Mechanism of hormones action	2
14.	Vitamins (Fat & Water soluble)	6
15.	Nutrition	2
16.	Chemistry of Purines and Pyrimidines	2
17.	Purine and Pyrimidine metabolism	3
18.	Chemistry and functions of Nucleic acids; Protein biosynthesis, Gene expression, mutations, Genetic engineering and its applications.	6
19.	Biochemistry of cancer	1
20.	Radioisotopes	1

21.	Liver function tests, Detoxification mechanisms	2
22.	Kidney function tests, thyroid function tests	2
23.	Mineral Metabolism.	6
24.	Water and Electrolyte Balance	2
25.	Acid base balance	3
26.	Environmental Biochemistry	1
27.	Molecular concepts of body defence.	1

1.5 EXAMINATION:-

1.5.1 THEORY EXAMINATION:

There will be TWO papers, each of two and half hours duration. Each paper will be of 50 marks with one compulsory question on applied biochemistry.

PAPER WISE DISTRIBUTION OF THEORY TOPICS :

(Structural formulae are not obligatory.)

PAPER – I (50 MARKS) 2½ HOURS DURATION.

1. Molecular and functional organization of a cell and its sub-cellular components.
2. Chemistry and metabolism of proteins and related disorders, Tissue proteins in health and diseases
3. Chemistry and metabolism of purines and pyrimidines and related disorders.
4. Chemistry and functions of DNA and RNA, genetic code; protein biosynthesis & regulation of gene expression.
5. The prinicples of genetic engineering and their applications in medicine.
6. Chemistry and Metabolism of haemoglobin.
7. Molecular concept of body defence and their applications in medicine.
8. Nutrition, Vitamins and Minerals.
9. Investigation techniques: (LCD-Topics) Colorimeter, Electrophoresis, Chromatography, ELISA & Flame photometer, Automation.

PAPER – II (50 MARKS) 2 ½ HOURS DURATION.

1. Chemistry and metabolism of carbohydrates and related disorders.
2. Chemistry and metabolism of lipids and related disorders.
3. Water and electrolyte balance & imbalance.
4. Acid base balance and imbalance.
5. Integration of various aspects of metabolism and their regulatory pathways. Starvation metabolism.
6. Mechanism of hormone action.
7. Environmental biochemistry.
8. Liver function tests, Kidney function tests, Thyroid function tests.
9. Detoxification mechanisms.
10. Biochemical basis of cancer and carcinogenesis.
11. Radioisotopes.
12. Enzymes and Biological oxidation.

1.5.2 PRACTICAL EXAMINATION :

Practical examination in Biochemistry will be40 marks of 2 hours duration.

EXERCISE

Q.No.1	One quantitative experiment from group A	20 marks
Q.No.2	One qualitative / quantitative experiment from group B	15 marks
Q.No.3	Spot identification from group C	05 marks

Group A:

Blood sugar, Blood urea; Serum total protein, Albumin, Serum ALT/SGPT, Serum AST/SGOT, Serum Alkaline phosphatase, Serum Acid phosphatase, Serum total and direct bilirubin, Serum uric acid, Serum calcium, CSF- sugar and protein.

Group B:

Creatinine in urine, Serum cholesterol, Serum phosphorus, Tests for monosaccharides, Tests for disaccharides, Colour reactions of proteins, Precipitation reactions of proteins and abnormal constituents of urine.

Group C:

Identification of slide under microscope.
Use of reagent.
Significance of test.
Use of Instrument / Appliances.
Identification of GTT, Electrophoretogram and Chromatogram.
Candidates will be allowed to use Test procedures for quantitative and qualitative exercises. There will be table viva on Q.No.1 & Q.No.2 exercise.

1.6 PATTERN OF QUESTION PAPER :-

TIME ALLOWED: - 2.30 HOURS FOR EACH PAPER

PAPER I				
			Marks	**Total**
SECTION **A**	Question **1**	**One Sentence Answer Questions** (10 Out of 12)	10x1 =10	26
	Question **2**	**Long Answer Questions** (2 Out of 3)	8x2 = 16	
SECTION **B**	Question **3**	**a) Problem based Learning** (Compulsory)	1x3 = 03	03
		b) Short Answer Questions (7 Out of 9)	7x3 = 21	21
			Total =	**50**

PAPER II				
			Marks	**Total**
SECTION **A**	Question **1**	**One Sentence Answer Questions** (10 Out of 12)	10X1=10	**26**
	Question **2**	**Long Answer Questions** (2 Out of 3)	8X2 = 16	
SECTION **B**	Question **3**	**a) Problem based Learning** (Compulsory)	1X 3=03	03
		b) Short Answer Questions (7 Out of 9)	7X 3=21	21
			Total =	**50**

1.7 Theory & Viva

Theory viva (Paper I & II)	15 marks
Interpretation of case history &Lab. data	05 marks.
Total	**20 Marks**

1.8 Practical:

Q.1. Quantitative.	20 marks.
Q.2. Qualitative / Quantitative	15 marks.
Q.3. Spotting.	05 marks.
Total	**40 marks.**

1.9 Internal assessment

Theory	20 marks.
Practical	20 marks.
Total	40 marks.

STANDARD OF PASSING:
In each of the subjects a candidate must obtain 50% in aggregate with 50% in Theory + orals, 50% in Practicals.

1.10 BOOKS RECOMMENDED:-

- Biochemistry for Medical students by D.M.Vasudevan& Shree Kumari.
- Medical Biochemistry – U.Satyanarayan
- Biochemistry by PankajaNaik

1.11 REFERENCE BOOKS:

- Harper's Biochemistry.
- Lippincott's Illustrated Reviews Biochemistry
- Biochemistry by L. Stryer.
- Lehninger's Principles of Biochemistry