Passed by Academic Council (Resolution No. 355/2006) dtd. 30/05/2006, subject to Uniformity in the Examination pattern.

MAHARASHTRA UNIVERSITY OF HEALTH SCIENCES,NASHIK.

SYLLABUS FOR M.D. BIOCHEMISTRY

May 2006 ONWARDS.

Goal :

The broad goal of teaching & training of postgraduate students in Medical Biochemistry is to make them understand the scientific basics of the life processes at the molecular level and to orient them towards the applications of the knowledge acquired in solving clinical problems. At the end of his/her training, the student shall be able to take up a career in Teaching Institution or in diagnostic laboratory or in Research.

OBJECTIVES:

A) KNOWLEDGE:

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

1) Explain the structure, function & inter-relationships of bimolecules & their deviation from normal & their consequences.
2) Summarize the fundamental aspects of enzymology & alteration on enzymatic activity with reference to clinical applications.
3) Explain the molecular & biochemical basis of inherited disorders with their associated sequel.
4) Explain the mechanisms involved in maintenance of body fluids & pH homeostasis.
5) Integrate the various aspects of metabolism & their regulatory pathways.
6) Outline the molecular mechanisms of gene expression & regulation, the principles of genetic engineering & their application in medicine.
7) Explain the molecular concept of body defenses & their applications in medicine
8) Explain the biochemical basis of environmental health hazards, biochemical basis of cancer & Carcinogenesis.

9) Familiarize with the principles of various conventional & specialized laboratory investigations & instrumentation analysis and interpretation of a given data.
10) Effectively organize & supervise diagnostic laboratory to ensure quality control/Assurances.

B) SKILLLS:

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

1) Make use of conventional techniques/instruments to perform biochemical analysis relevant to clinical screening & diagnosis.
2) Analyze & interpret investigative data.
3) Demonstrate the skills of solving scientific & clinical problems and decision-making.
4) Develop skills as a self-directed learner, recognize continuing educational needs, select & use appropriate learning resources.
5) Demonstrate competence in basic concept of research methodology & be able to critically analyze relevant published research literature.

C) INTEGRATION:

The knowledge acquired in Biochemistry shall help the students to integrate molecular event with structure & function of the human body in health & disease.

1) Eligibility – Recognized degree of M.B.B.S. or its equivalent recognized qualification.
2) Duration of course shall be of 3 (Three) years from the date of admission.

PERIOD OF TRAINING:

Duration of the course shall be of three years (six academic terms) from the date of admission.

1) The students will attend all U.G. lectures and practicals and will work in central clinical laboratory of the hospital and do all the routine, emergency and special investigations.

2) The students will be posted in the Dept. of Pathology & Microbiology for a period of one month each to learn hematology ,Blood grouping & serology etc.
3) The students will be posted in the Dept. of Medicine to study the Clinical cases for a period of 3 months. However, they will attend P.G. activities and duties in in the Department of Biochemistry & Central Clinical Laboratory of the Hospital.
4) Students will paticipate in P.G. activities ; viz, Seminars ,Group discussion, Journal club etc. and will attend P.G. Lecture
5) Students should learn basic knowledge of computers and medical statistics.
6) Training in Medical audit ,management , health economics , health information system,basics of medical statistics & bioinformatics , exposure to human behavioural studies & medical ethics shall be imparted to the P.G. students.
7) They will be required to participate in the teaching & traning programmes of U.G. students.
8) They will be granted a term provided they will put 80% attendance during the academic term.

SCHEME OF EXAMINATION

(*As per Direction No. 01/2008 dtd. 26/05/2008)*

Syllabus For M.D. Biochemistry

Paper I (General Biochemistry and Instrumentation)

1) History & scope of Biochemistry.
2) Cell structure & biochemical functions .Membrane structure & functions.
3) Transport through biological cell membrane
4) Chemistry & biological importance of carbohydrates ,proteins & amino acids, lipids , nucleic acids, porphyrins glycosaminoglycans, glycoproteins.
5) Chemistry of blood & hemoglobin, plasma proteins,Blood coagulation.
6) Enzymes & coenzymes –chemistry ,nomenclature properties & mode of action of enzymes,Enzyme kinetics, factors affecting enzyme activity,enzyme inhibitions,applications of enzymes & isoenzymes.
7) Bioenergetics & biological oxidation-General concept of oxidation & reduction.Electron transport Chain (ETC)- functioning of ETC & inhibitors of ETC, Oxidative phosphorylation,Uncouplers and theories of Biological oxidation & oxidative phosphorylation.
8) Principle, working & applications of, a) Colorimetry b)Spectrophotometry c)Flame photometry d) Flurometry e)Atomic absorption spectroscopy g) ultra centrifugation
9) Principle, types& applications of , a)Electrophoresis b)chromatography
10) Autoanalyzers, Blood gas analyzers
11) Automation in clinical chemistry
12) pH, electrodes & methods of pH determination.
13) Basics of Mass spectroscopy, Nuclear Magnetic Resonance, chemiluminescence and Electron - microscopy
14) Environmental Biochemistry – Definition, importance of pollution free & ecofriendly environment, exposure to cold stress, exposure to heat , air pollution water pollution & food pollution
15) Immunochemistry – The Immune system, Immunoglobins, antigen –antibody mediated immunity, mononuclear phagocytes –macrophages ,elements of clinical immunity.

Paper- II: METABOLISM AND NUTRITION

1) Digestion & absorption from gastrointestinal tract.
2) Intermediary metabolism, metabolism of Carbohydrates, Lipids, Proteins , and Amino acids , Nucleic acids,Hemoglobin, metabolic control, energy production & regulation.
3) Metabolic interrelationships & regulatory mechanisms
4) Metabolic changes during starvation
5) Energy metabolism-Calorimetry, BMR- its determination & factors affecting it, SDA of food.
6) Macro & micro –elements & their role in health & disease, water metabolism & its regulation.
7) Vitamins- chemistry, biological importance , deficiency manifestations & recommended daily allowance.
8) Principles of Nutrition –Balanced diet & its planning, Nutritive importance of various food sources, Calorific value of food , toxins & additives , Obesity, Protein Energy Malnutrition (PEM)- Kwashirkor & Marasmus .
9) Diet in management of chronic diseases viz, Diabetes mellitus, Coronary artery disease, Renal disorders, Cancer, Hypertension, Anemia ,Rickets & Osteomalacia.
10) Diet for over weight person, pregnant woman and during lactation

PAPER –III CLINICAL BIOCHEMISTRY

1) Chemistry, composition & functions of lymph, CSF, ascitic fluid, pleural fluid, & synovial fluid.
2) Urine formation, excretion & urine analysis.
3) Composition, chemistry & functions of specialized tissues like muscle, bone, nerve, connective tissue, & brain adipose tissue.
4) Chemistry of respiration & acid base balance& imbalance
5) Hormones-: Communication among cells & tissues. Hormone- General mechanism of action of hormones, chemistry, functions, synthesis of steroid hormones , polypeptide hormones, & thyroid hormones. Chemistry & functions of hormones of pancreas, and parathyroid. Local hormones. Clinical disorders of hormones, Hormone receptors.
6) Biochemistry of Diabetes mellitus, Atherosclerosis, Fatty liver, and obesity.
7) Organ function tests
   a) Liver function tests
   b) Kidney function tests
   c) Thyroid function tests.
   d) Adrenal function tests
   e) Pancreatic function tests
   f) Gastric function tests
8) Radioisotopes & their clinical applications.
9) Biochemistry of aging.
10) Neurochemistry in Health & Disease.
11) Biochemical changes in pregnancy & lactation.
12) Water & electrolytes balance & imbalance.
13) Total Quality Management of Laboratories.
   a) Internal Quality control
   b) External Quality control
   c) Accreditation of laboratories
14) Basics of Medical statistics
15) Inborn errors of metabolism.
16) Biotrasformations of Xenobiotics
17) Basic concepts of Biochemical Defense Mechanisms

Paper IV

MOLECULAR BIOLOGY , BIOTECHNOLOGY & RECENT ADVANCES IN CLINICAL BIOCHEMISTRY

1) Central dogma, genetic code, protein biosynthesis & its regulation.
2) DNA: structure, functions, replications, Mutation & repair of DNA, Sequencing of nucleotides in DNA, Mitochondrial DNA, and DNA recombination.
3) RNA: composition, types, structure & functions.
4) Role of Nucleic acids in diagnosis of Molecular diseases & infectious diseases
5) Mitochondrial DNA & diseases.
6) Human Genome Project.
7) Genes & chromosomes, Gene mapping, Chromosome walking etc.
8)Gene expression & gene amplification & gene regulation, Oncogenes, & biochemistry of cancer.
9) Genetic engineering: Recombinant DNA technology & its applications. Restriction endonucleases, Plasmids, Cosmids, Gene cloning, Gene libraries.
10) Basics techniques in genetic engineering.
    a) Isolation & purification of DNA, Methods of DNA assay.
    b) Blotting techniques – Southern, Northern & Western blotting.
    c) Polymerase chain reaction & its applications.
    d) Ligase chain reaction & its applications.
11) Tumor markers & growth factors
12) Biotechnology: Gene therapy, Nucleic acid hybridization, and DNA probes, Microarray of gene probes.
13) Genomics and Proteomics
14) Medical Bioinformatics
15) Lipid peroxidation, free radicals & antioxidants, Nitric oxide formation & its metabolism & its role in Medicine.
16.)Biochemistry of AIDS
17.)Genetic control of Immunity
18.)Research Methodology & Medical ethics.

SYLLABUS FOR PRACTICALS :

1) All undergraduate practicals and routine emergency and special investigations carried out in central clinical laboratory of the hospital,which are useful for diagnosis and prognosis of the disease.
2) Total Quality Management of Laboratory
   a)Specimen collection , handling & storage of sample.
   b) Methods of standardization & calibration.
   c) Methods of quality control & assessment.
3) Fractionation & Identification of,

   a) Amino acids b) Sugar c) Proteins d) Lipoproteins by

   i) Thin Layer Chromatography ii) Paper chromatography (circular, Uni-dimensional& two dimentional iii) Gel electrophoresis- agarose, starch, & Polyacrylamide Gel Electrophoresis iv) paper electrophoresis & cellulose acetate paper electrophoresis .

4) a) Estimation of total activity of following enzymes .
   i. LDH & seperation of its isoenzymes by Polyacryamide gel electrophoresis, Cellulose acetate electrophoresis & quantitation by densitometry.
   ii. AST(GOT)
   iii. ALT(GPT)
   iv. Alkaline phosphatase
   v. Acid phosphatase
   vi. Amylase
   vii. Creatine kinase its Isoenzymes

   b) Enzyme kinetics and Determination of Km value and effect of pH substrate concentration & temperature on Enzyme activity.
   c) Endocrinology: Estimation of Hormones.

5) Isolation of DNA and PCR technique.

6) Estimation of serum lipid profile .

i) Serum total cholesterol

ii) Serum HDL cholesterol

iii) Serum VLDL & LDL

iv) Serum Triglycerides

v) Serum Phopholipids

7) Estimation of Fe & Total Iron Binding capacity,& ferritin

8) Estimation of Glycosylated Hb.

9) Body fluid analysis - Urine
- CSF
- Ascitic fluid
- Pleural fluid

10) Estimation of VMA.

11) Estimation of Na, K & Lithium by Flame photometer.

Dissertation:

The dissertation is compulsory for candidates registered for P.G. degree & should include candidates own work under a supervisor , qualified for the purpose & recognized as a P.G. teacher by the University. The subject of dissertation along with synopsis (about 200 words) signed by P.G. teacher, H.O.D.& Head of the Institution will be submitted to the University. Ethics Committee of the Institution must approve the topic of dissertation.

Completed dissertation will be submitted to the University in the 5th term, that is, 6 month before the date of final examination.

Books recomonded:

1)Bichemistry Ed Lubert Stryer . W.H. Freeman & company ,New york.

2)Principles of Biochemistry . Ed. Lehninger , Nelson & Cox .
CBS publishers & distributers .

3)Harpers Biochemistry Ed. R.K. Murray , D.K. Granner, P.A. Mayes & V.W.Rodwell.
Appleton & Lange ,Stanford ,Conneticut.

4)Textbook of Biochemistry with clinical correlations. Ed. Thomas M. Devlin.
Wiley Liss Publishers.

5)Genes VI Ed. Benjamin Lewin .
Oxford University press.

6) Tietz Textbook of Clinical chemistry, Ed. Burtis & Ashwood W.B.
Saunders Company.

7)Principles & techniques of practical Biochemistry Ed. Keith Wilson & John Walker
Cambridge University press .

8)Biochemistry Ed. Donald Voet & Judith G. Voet
John Wiley & Sons ,Inc.

9)Molecular cloning –A laboratory Manual .J. Sambrook , E.F. Fritsch & T.Maniatis
Cold Spring Harbor Laboratory Press.

10)Molecular cell Biology , H.Lodish,A. Berk, S.L. Zipursky, P. Matsudaira ,D. Baltimore , J.Darnell.

11)Bio-technology 1st edition . U. Satyanarayan.
Books & Allied Publisher (p) Ltd.Kolkatta.