

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.Sc. (Medical 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 biomolecules & 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 – M.B.B.S./B.Sc.with Chemistry /Biology/ Zoology / Botany/ Biotechnology from a recognized qualification.
- 2) Duration of course shall be of 3 (Three) years from the date of admission.

PERIOD OF TRAINING:

- 1) The period of training for M.SC. (Medical Biochemistry) shall be of three years that is, six academic terms after registration as a post graduate student.
- 2) Number of Registration: The ratio of recognized post graduate teacher to number of students to be admitted for M.Sc. (Medical Biochemistry) shall be 1:1.P.G. teacher shall not register M.D. (Biochemistry) and M.Sc. (Medical Biochemistry) student simultaneously in one academic year .

- 3) M.Sc.(Medical Biochemistry) students shall attend all Lectures ,Tutorials, and practicals along with 1st M.B.B.s. students.Orientation shall be given to these students in Anatomy and Physiology.
- 4) Candidates joinng M.Sc.(Medical Biochemistry) course shall work as full time P.G. student & he/she will not be paid any stipend during the training prriod & he/she will be given full time responsibility, assignments & participation in all facets of the educational process .
- 5) P.G. student shall maintain a record (log) book of the work carried out by them & will be checked & assessed by his/her P.G. teacher & H.O.D.
- 6) P.G. students shall work in central laboratory & would carry out routine, emergency & special investigations during training period.
- 7) They shall participate in all P.G. activities ; viz, Seminars ,Group discussion, Journal club etc.
- 8) They will be required to participate in the teaching & training programmes of U.G. students.
- 9) 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.
- 10) 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) Biotransformations 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 dimensional 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 & separation of its isoenzymes by Polyacrylamide 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 K_m 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 Phospholipids
- 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 candidate's 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 months before the date of final examination.

Books recomended:

- 1) Biochemistry Ed Lubert Stryer . W.H. Freeman & company ,New york.
- 2) Principles of Biochemistry . Ed. Lehninger , Nelson & Cox .
CBS publishers & distributors .
- 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.