PERIYAR UNIVERSITY
PERIYAR PALKALAI NAGAR
SALEM – 636 011

DEGREE OF MASTER OF PHILOSOPHY

CHOICE BASED CREDIT SYSTEM

SYLLABUS FOR M.PHIL. BIOCHEMISTRY

FOR THE STUDENTS ADMITTED FROM THE

ACADEMIC YEAR 2012 – 2013 ONWARDS

Objective of the Course

The main objective of this course is

- To mould student's skills and individuality in Biochemistry research.
- To motivate students to build a bridge between research and industry.

Eligibility for admission

Candidate who have qualified for post graduate degree in Biochemistry of any recognized university shall be eligible to register for the Degree of Master of Philosophy (M.Phil) in Biochemistry .

For full-time M.Phil registration ,candidates shall be required to have obtained a minimum of 55% marks .except for whom have qualified their P.G degree on or before 1st January 1991 and those who have qualified for the Masters Degree before 01.01.91.

In case of teacher or other candidates registering for part –time M.Phil candidates belonging to SC/ST community, the minimum percentage of marks for registration is 50%.

Duration:

The duration of the M.Phil Course shall extend over a period of one year from the commencement**.**

Structure of the course:

The course of study for the degree shall consist of

Part –I comprising three written papers according to the Syllabus prescribed from time to time .Part I shall consist of Paper I Research Methodology and Paper II Analytical Technique .There shall be a third paper which shall be the background paper relating to the proposed Dissertation conducted internally by the department .

Part –II is Dissertation

Scheme of Examination

Part –I Written Examination: Papers I, II and III

The examination of paper I, II and III shall be held at the end of the year. The duration for each paper shall be 3 hours carrying a maximum a maximum of 100 marks.

The department will conduct paper -III examination and the marks obtained by the candidate along with the question paper and valued answer scripts shall be sent to the head of the Institution atleast 15 days before the commencement of the examination of papers I and II.

The examiners will be appointment from the panel of four names of each paper submitted by the department .If one examiner award a pass mark and the other award fail mark ,the paper will be valued by a third examiner whose award of marks will be the final .

Part II- Dissertation

The exact title of the Dissertation shall be intimated within one month after the completion of the written examination. The students will not be permitted to make any changes in the title after completing the paper III examination .Candidates shall submit the Dissertation to the university through the Supervisor and the head of the department at the end of the year from the commencement of the course which shall be valued by internal examiner (Supervisor) and one external examiner appointed by the University from a panel of four names sent by the supervisor through the Head of the Department at the time of submitting the dissertation .

The examiners who value the Dissertation shall report on merit of candidate as “Highly Commended “(75% and above) or “Commended “(50 % and above and below 75%) or “Not Commended”(below 50%).

If one examiner commends the Dissertation and the other examiner, does not commend, the dissertation will be referred to a third examiner and the third valuation will be the final.

Submission or resubmission of the Dissertation will allowed twice a year.

Passing Minimum

A candidate shall be declared to have passed Part –I of the examination if he/she secures not less than 50% of the marks in each paper including paper –III for which examination is conducted internally.

A candidate shall be declared to have passed Part –II of the examination, if his/her dissertation is atleast commended.

All other candidate shall be declared to have failed in the examination.

Part	Course	Course code	Name Of The course	Credit	Total
I	Core I		Research Methodology	4	100
	Core II		Analytical Techniques	4	100
	Core III		GUIDE PAPER	4	100
II	Core		Dissertation Evaluation -150 Viva voce-50	12	200
			Total	24	500

CORE -1

RESEARCH METHODOLOGY

UNIT I

Scientific Research

Overview of scientific research, improvement through research and applications of research. Choosing a topic and formulation of hypothesis. Designing and investigation techniques to be employed, analysis of results. Use of microorganisms, animals, plants and humans in experimentation.

Scientific writing – logical format for writing thesis and papers – abstract, introduction, review of literature, materials and methods, results – illustration by tables and figures, discussion, and bibliography – Harvard and Vancouver systems.

UNIT II

Bioinformatics

The scope of bioinformatics. The internet. The world wide web. File formats. Biological data bases-sequence and structure-NCBI,PDB. Data retrieval – the Entez system. Searching sequence databases – sequence similarity searches, substitution matrices. Database search-FASTA and BLAST. Protein multiple sequence alignments-CLUSTAL.

UNIT III

Biostatistics

Collection and classification of data – diagrammatic and graphic representation of data – measurement of central tendency – standard deviation – normal distribution – test of significance based on large samples – small samples – student t test – correlation and regression – Chi square test for independents of attributes – ANOVA. Use of SPSS software.

UNIT IV

Safety, general guidelines and funding agencies

Biosafety – Introduction. Levels of Biosafety. General guidelines and practices. Guidelines for DNA research activities. General guidelines for research in transgenic plants, Good laboratory practices. Containments – Types, Basic Laboratory and Maximum Containment Laboratory.

Research bodies & funding agencies – UGC, CSIR, ICMR, DST, DBT,ICAR, DAE, DRDO, DOD, Fellowships – Junior, Senior Research Fellowships and Research associates.

UNIT V

Bioethics and Patenting

Declaration of Bologna, Ethics in animal experimentation, CPCSEA guidelines – animal care and technical personnel, environment, animal husbandry, feed, bedding, water, sanitation and cleanliness, waste disposal, anesthesia and euthanasia.

Composition of (human) Institutional evaluation Ethical Committee (IEC) – Beneral ethical issues. Specific principles for clinical evaluation of drugs, herbal rededies and human genetics. Ethics in food and drug safety. Environmental release of microorganisms and genetically engineered organisms. Ethical issues in human gene therapy, cloning and embryonic stem cell.

Patenting – definition of patent – different types of intellectual property right,. Case studies of patents (basmati rice, turmeric, neem). Product and process. Patenting multicellular organisms. Patenting and fundamental research.

REFERENCE BOOKS.

1. R.A.Day. How to write a scientific paper. Cambridge university press.
2. Cooray P.G.Guide to scientific and technical writing.
3. Carter V Good and Douglas E seats Methods of Research.
4. Alley, Michael. The craft of scientific writing Englewood Cliffs. N.N.Prentic 1987.
5. M.C. Sharma, Desk Top Publishing on PC, BPB Publications, 1887.
6. Lesk, A.M. Introduction to Bioinformatics Oxford 2002.
7. Krane et al fundamental concepts of bioinformatics Benjamin Cummings.
8. Sundar Rao, Jesudian Richard – An introduction to Biostatistics.
9. S.P.Gupta – Fundamentals of statistics, Sultan Chand.
10. Ethics and the use of alternatives to animals in research and education. Shiranee Pereira.CPCSEA.
11. CPCSEA guidelines for laboratory animal (CPCSEA) – No.13 Scaward road, Valmiki Nager Chennai – 41.
12. Ethical guidelines for biomedical research on human subjects. ICMR, New Delhi, 2000.
13. Dickson. Molecular and cell biology of human gence therapeutics. Series Chapman and Hall 1995.
14. Research and Development Funding Schemes of Central Government Departments and Agencies. Ministry of Science and Technology, Departement of Science and Technology, New Mehrauli Road, New Delhi – 110106.

PAPER -2

Analytical Techniques

UNIT – I

Spectroscopy and Centrifugation

Principle, instrumentation, and applications of UV-visible spectrophotometry, Vibrational spectroscopy, NMR, ESR, Spectrofluorimetry and luminometery. X-ray diffraction. Atomic spectroscopy – principle and applications of atomic flame and flameless spectrphotometry. Uses of LASER for spectroscopy.

Principle, instrumentation and applications of centrifugation. Preparative ultracentrifugation – differential centrifugation, density gradient centrifugation (rate-zonal & isopycnic). Analytical ultracentrifugation – molecular weight determination.

UNIT – II

Chromatography and Electrophoresis

General principles, instrumentation and applications of chromatography – TLC, GLC, HPLC, ion exchange, molecular exclusion, affinity chromatography.

General principles and instrumentation. Electrophoresis of proteins – native gels, gradient gels, SDS Page, Isoelectric focusing, 2-D PAGE, Detection, estimation and recovery of proteins in gels. Western blotting. Electrophoresis of nucleic acids – agarose gel electrophoresis, DNA sequencing gels, pulsed – field gel electrophoresis, capillary electrophoresis.

UNIT – III

Radiation and Immunotechniques

Principles and applications of tracer techniques in biology. Radiation hazards, prevention and safety measures. Detection and measurement of radioactivity, radiation dosimetry, solid and liquid scintillations counting – Cerenkov radiation. Autoradiography.

Production and applications of antisera and monoclonal antibodies, Antigen – antibody interaction – precipitation reaction, immunodiffusion, immunoelectrophoresis, immunofluorescence. RIA and ELISA – hormonal assay. HLA typing. Lymphocyte isolation and complement fixation. Immunohistochemistry, immunoelectron microscopy.

UNIT – IV

Molecular Biology Techniques

Sequencing DNA – enzymic and chemical methods. Blotting techniques – Southern & Northern analysis. DNA finger printing, footprinting. DNA makers – RFLP and RAPD. PCR – principle and applications – RT PCR, real time PCR In situ hybridization and FISH. DNA chip technology and microarrays.

Genome and proteome analysis – EI – MS, MALDI, SELDI, CI & MALDI – TOF.

UNIT – V

Cell and Tissue Culture Plants and Animals

Animal cell and tissue culture – laboratory facilities, culture media and procedures, primary culture and cell lines, pluripotent stem cell lines, organ and embryo culture.

Plant cell and tissue culture media and cell culture, tissue culture, micropropagation and somoclonal variation, production and uses of haploids, protoplast culture, regeneration and somatic hybridization. Gene transfer methods in plants.

Microscopy – Principles and application of light, phase, contrast fluorescence, scanning and transmission electron microscopy, fixation and staning.

REFERENCE BOOKS:

1. Instrumental Methods of Analysis, Williams, Merrit etal.
2. Scientific Foundations of Clinical Biochemistry, Williams and Marks.
3. Concepts in Biotechnology, ed: D.Balasubramaniam. Costed IBN, University Press, India 1996.
4. Principles and Techniques in Practical Biochemistry. Wilson and Walker, 4th edition. Cambridge University Press.
5. Biotechnology and Genomics, P.K.Gupta, Rastogi publications 2004, India.
6. Biophysical Chemistry, Principles and Techniques, Upadhay and Nath, Himalaya publishing house, India.

PAPER: 3 (GUIDE PAPER)

GUIDE PAPER-I

ENZYMOLOGY

UNIT- I

ISOLATION, EXTRACTION AND PURIFICATION OF ENZYMES

Enzymes –General introduction ,source of enzymes ,Isolation of enzymes ,extraction of soluble enzymes ,membrane bound enzyme ,cell disintegration and extraction .Purification of enzymes ,Recombinant proteins,membrane protein and purification of antibodies .Development of enzyme assay,quantification of enzyme activity .Mechanism of enzyme catalysis.

UNIT- II

ENZYME KINETICS

Kinetics of enzyme catalysed reaction –kinetics of single substrate enzyme ; the Eadie Hofstee and Hanes plot ,rapid reaction kinetics ; pre –steady state kinetics ,relaxation kinetics ,King and Altman procedure ,multi-substrate enzyme catalysed reactions; steady state and non –steady state methods .Enzyme inhibition ;reversible inhibition and Irreversible inhibition .Mixed inhibition ,partial inhibition ,substrate inhibition ,Allosteric inhibition and regulation.

UNIT- III

TECHNIQUES OF ENZYMOLOGY

Instrumental techniques: Electrochemical methods, Enthalimeter, Radiochemical methods and Dry –reagent techniques. Automation in enzymatic analysis: Fixed –time methods fixed concentration methods and methods involving continuous monitoring. Biosensors ,Application of biosensors –Analysis- measurement of protein and enzyme activity – UV Absorption , Lowry ,Dye binding ,Bicinchonic acid .Active site –Investigations of active site structure ,Trapping ES complex ,Use of substrate analogues, Modification by using chemical procedures ,enzymes modification by treatment with protease ,enzyme modification by site directed mutagenesis

UNIT- IV

IMMOBILIZATION OF ENZYMES AND ENZYME ENGINEERING

Preparation of immobilized enzymes: properties of immobilized enzymes .Application of immobilized enzymes .Bioconversion studies with immobilized enzyme packed-Bed bioreactor .Determination of protein structure: Primary structure and its determination, secondary structure prediction and determination of super secondary structure and domain in protein, quaternary structure, and methods to determine tertiary and quaternary structure, X-ray crystallography, sequencing .Protein data base analysis ,methods to alter primary structure of protein ,examples of engineered protein ,protein design ,principles and examples .

UNIT- V

INDUSTRIAL UTILISATION OF ENZYMES

Large –Scale application of microbial enzymes in food and allied industries .Leather industry, textiles, paper industries, Medical application of enzymes .Enzymes in aqueous biphasic system, Inter esterification of lipids.

REFERENCE BOOKS.

1. Enzymes By Dixon , E.C Webb, CJR Thorne and K.F. Tipton, Longmans , London.
2. Fundamentals of Enzymology 2 ed., (1998) By Nicholas C.Price, Lewis Stevans, Oxford University Press, First Edition (1990).
3. Understanding Enzymes, Trevor Palmer, Ellis Horwood Limited, Third Edition(1991).
4. Protein Biotechnology, Gary Walsh and Denis Headon, John Wiley and Sons,1994.
5. Protein Biochemistry and Biotechnology, Gary Walsh and John Wiley and Sons Ltd.2002.
6. Enzyme kinetics and Mechanism –Paul F.Cook
7. The Chemical kinetics of enzyme action by K.J Laidler and P.S.Bunting

8. Enzymes structure and Mechanism 2nd ed., (1985) by Alan Fersht ,W.H.Freeman and company
9. Enzymatic reaction mechanism (1979) by Christopher Walsh FreemanPub,San Francisco
10. Immoblised enzymes by Ichiro Chibata,Halsted press Book
11. Enzyme structure and function by S. Blackburn (1976) Marcel Dekker,Inc.,NY

GUIDE PAPER-II (PAPER -3)

UNIT- I

Introduction : An overview of Indian Medicine Ayuveda .Traditional medicine /Ethnomedicine .Classification ,taxonomy and phytochemistry of Medicinal Plants .Therapeutic potential of Medicinal plants- A global perspective .Recent development of some natural products.

UNIT- II

Secondary Metabolites : Definition ,types (Alkaloids,Steroids ,glycosides and flavonoids).Structure ,Chemistry ,Biosynthesis ,Metabolism and Regulation of Secondary Metabolites ,Secondary metabolites as plant therapeutics,Economic importance of Secondary products**.**

UNIT- III

Screening of Secondary Metabolites –Phytochemical analysis,Biochemical methods ,qualitative and quantitative analysis –Separation procedures ,Purification ,and Structural elucidation of secondary compounds of therapeutic potential by HPLC and NMR Spectroscopy .

UNIT- IV

An overview of Liver metabolism and function .Anatomy and Physiological Significance of Liver and kidney .Liver disease ,Kidney disorders ,Molecular basis of Liver and Kidney disorders, Liver toxicity ,Nephrotoxicity .Animal Models –Basis for clinical studies ,Inflammatory disease – Allopathy and Ayurveda.

UNIT- V

Free radicals –Introduction ,Modern theory of free radical ,Oxidative Stress ,Free radicals Scavengers .Antioxidants-Definition ,property and biological significance ,Antioxidants –Enzymes and Vitamins .Antioxidants as markers for liver and kidney disease.Medicinal plants as a source of Direct and Indirect antioxidant activity

REFERENCE BOOKS:

1. Handass ,Kaul.M.K,1996.Supplement to cultivation and utilization of medicinal; plants .
2. Basic Medical Biochemistry –A Clinical approach second edition ,Collen Smith ,Allan.D.
3. Plant Biochemistry –Recent Advances by Trivedi .P.C.
4. Role of Biotechnology in Medicinal and Aromatic Plants ,Volume II By Irfen .A .Khan .Atiya Khanum.
5. Plant Biochemistry by Dey and J.B. Harborne
6. Plant biochemistry and Molecular biology by Peter J .Lea, Richard .C. Leegood
7. Biochemistry and Molecular Biology of Plants – Buchanan,Grussem Jones
8. Methods in Plant biochemistry and Molecular biology by William .V.Dashek
9. Introduction to plant Biochemistry by T.W.Goodwin and E.I .Mercer.
10. Biochemistry 4^{th} edition (1988) by Zubay G L , W M C Brown Publishers.
11. Medicinal plants in India ,Indian Journal of Medical Research Seth S.D, Bhavana Sharma .
12. Antioxidants properties of some therapeutically active medicinal plant –an overview Gajera.H.P,Patel Sr .Gdakiya

ENERAL REFERENCE

- Robbins Pathologic Basis of Disease. Cotran, R.S. *et al.,* 5th ed. Saunders, 1994.

- An Introduction to the Principles of Disease. Walter, J.B., 3rd ed. Saunders, 1992.

- Harrison's Principles of Internal Medicine. Wilson, J.D. *et al.,* 14th ed. McGraw Hill,1997.

- The Metabolic Basis of Inherited Disease. Scriver, C.R., Beaudet, A.L., Sly, W.S., Valle, D., 7th ed. .r-McGraw Hill, 1995.

- Current Diagnosis. Conn, RB. et *al.,* 9th eeL. Saunders, 1997.

- Current Medical Diagnosis and Treatment 1999. Schroeder, S.A. *et al.,* 38th ed. Lange, 1998.

- Williams Textbook of Endocrinology. v.iilson, J.D. and Foster, D.W., 9th ed. Saunders, 1998.

- Goodman arid Gilman's The Pharmacologic Basis of . Therapeutics. Gilman, A.G. et *al.,* 9th ed. MacMillan, 1996.

- Basic and Clinical Endocrinology. Greenspan, F.S Forsham, P.H. (Eds.), 4th ed. Lange Series, Appleton and Lange, 1997.

JOURNALS

- Journal of Clinical Pathology

- Annals of Clinical Biochemistry

- Annals of Internal Medicine

- British Medical Journal
- Clinical Chimica Acta
- Clinical Chemistry
- Clinical Biochemistry
- Clinics in Endocrinology and Metabolism
- Clinics in Laboratory Medicine
- Critical Review of Clinical Laboratory Sciences
- Current Clinical Chemistry'
- Endocrinology
- Journal of Bone and Mineral Research
- Journal of Clinical Chemistry and Biochemistry
- Journal of g1mical Endocrinology and Metabolism
- Journal Clinical and Laboratory Medicine
- Journal of Clinical Pathology
- Lancet
- New England Journal of Medicine
- Pediatric Research

- Therapeutic Drug Monitoring

- Scandinavian Journal of Clinical and Laboratory Investigation .

- Science.

- Online Journals: see the CSCC web site: . www.cscc.ca/library .shtml

Web sites

- Medical Biochemistry 8 /19/ 2002

- UMMS - Biochemistry http:// jwww.ummed.edu/. dept/ courses/weblinksjbiochem.html

- Biochemistry Review Tables 8/19/ 2002

- Glycolysis and the Krebs Cycle 8/19/2002

- KEGG Metabolic Pathways 8/ 19/2002

- Metabolic, Pathways of Biochemistry 8/ *19/2002*
- Stryer Biochemistry 8/ 19/2002
- Interactive Biochemistry' Web Links 8 19/2002
- BioChemNet: Biochemistry http://schmidel.com bionet/biochem.htm

- F1ATPase 8/19/2002
- The F1-ATPase 8/19/2002

- ATPase 8/19/2002
- MITOMAP: A human mitochondrial genome data
- http://www.gen.emory.edu/mitomap.html .

- CancerNet-Credible, current, and comprehen cancer information from the National Cancer institute 8/19/2002
- British Medical Journal8/ 19/2002
- Liver Disorders 8/19/2002 .
- CBS Health Watch http:/ /healthwatch.medscape
- The Nobel Foundation 8/19/2002
- ConsumerLab.com:independent tests of the, vitamin, and mineral supplements http: www.consumerlab.com
- NIH Office of Diet. Supplements ht odp.od.nih.gov / ods / databases / ibids.html
- Neuromuscular Home Page 8/19/2002
- Harvard Medi School Course Pages8/l9/2
- The WWW Virtual Library: Cell Biology: Metabolism and Cellular Respiration 81 19/2002
- bioethics.net http: j /www.med.upenn.edu/bioethicsj index.shtml
- The Online Ethics Center *8/19/2002*
- Food and Drug Administration http://www.fda.gCiVI
- healthfinder: a gateway consumer health and human services information web site
- *http* www.healthfinder.gov/