M. Sc Biochemistry
Syllabus
Semester Pattern
2012-2013

University Department of Biochemistry
Rashtrasant Tukadoji Maharaj
Nagpur University
Nagpur

M. Sc. Biochemistry Syllabus
Semester Pattern 2012-2013

Appendix -1
Scheme of teaching and examination under credit based semester pattern for M. Sc Programme in all subjects except Mathematics and M. Sc. (Tech) Applied Geology

Sr. No.	Semester	Theory Paper/ Practical	Teaching Scheme Hrs/week)			Credits	Duration (Hrs)	Examination Scheme				
								Max. Marks		Total Marks	Min. Passing Marks	
			Th.	Pr.	Total			External Marks	Internal Marks		Th.	Pr.
1.	I	I	4		4	4	3	100		100	40	
2.	I	II	4		4	4	3	100		100	40	
3.	I	III	4		4	4	3	100		100	40	
4.	I	IV	4		4	4	3	100		100	40	
5.	I	Practical I		8	8	4	3-8*	80	20	100		40
6.	I	Practical II		8	8	4	3-8*	80	20	100		40
7.	I	Seminar	2		2	1	---		25	25	10	
		Total	**18**	**16**	**34**	**25**				**625**	**170**	**80**

Sr. No.	Semester	Theory Paper/ Practical	Teaching Scheme Hrs/week)			Credits	Duration (Hrs)	Examination Scheme				
								Max. Marks		Total Marks	Min. Passing Marks	
			Th.	Pr.	Total			External Marks	Internal Marks		Th.	Pr.
1.	II	I	4		4	4	3	100		100	40	
2.	II	II	4		4	4	3	100		100	40	
3.	II	III	4		4	4	3	100		100	40	
4.	II	IV	4		4	4	3	100		100	40	
5.	II	Practical I		8	8	4	3-8*	80	20	100		40
6.	II	Practical II		8	8	4	3-8*	80	20	100		40
7.	II	Seminar	2		2	1	---		25	25	10	
		Total	**18**	**16**	**34**	**25**				**625**	**170**	**80**

Sr. No.	Semester	Theory Paper/ Practical	Teaching Scheme Hrs/week)			Credits	Duration (Hrs)	Examination Scheme				
								Max. Marks		Total Marks	Min. Passing Marks	
			Th.	Pr.	Total			External Marks	Internal Marks		Th.	Pr.
1.	III	I	4		4	4	3	100		100	40	
2.	III	II	4		4	4	3	100		100	40	
3.	III	III	4		4	4	3	100		100	40	
4.	III	IV	4		4	4	3	100		100	40	
5.	III	Practical I		8	8	4	3-8*	80	20	100		40
6.	III	Practical II		8	8	4	3-8*	80	20	100		40
7.	III	Seminar	2		2	1	---		25	25	10	
		Total	**18**	**16**	**34**	**25**				**625**	**170**	**80**

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Sr. No.	Semester	Theory Paper/ Practical	Teaching Scheme Hrs/week)			Credits	Duration (Hrs)	Examination Scheme				
								Max. Marks		Total Marks	Min. Passing Marks	
			Th.	Pr.	Total			External Marks	Internal Marks		Th.	Pr.
1.	IV	I	4		4	4	3	100		100	40	
2.	IV	II	4		4	4	3	100		100	40	
3.	IV	III	4		4	4	3	100		100	40	
4.	IV	IV	4		4	4	3	100		100	40	
5.	IV	Practical I		8	8	4	3-8*	80	20	100		40
6.	IV	Practical II		8	8	4	3-8*	80	20	100		40
7.	IV	Seminar	2		2	1	---		25	25	10	
		Total	**18**	**16**	**34**	**25**				**625**	**170**	**80**

Note: Th= Theory; Pr=Practical/Lab; *=If required, for two days*

1. In each semester student will have to give seminar on any one topic relevant to the syllabus encompassing the recent trends and development in that field. The topic of the seminar will be decided at the beginning of each semester in consultation with the supervising teachers. The student has to deliver the seminar which will be followed by discussion. The seminar will be open to all the teachers of the department, invitees, and students.

2. The student will have to carry out the research based project work in lieu of practical in the fourth semester in the department or depending on the availability of placement; he/she will be attached to any of the national/regional/private research institute/organization. The student in consultation with supervisor will finalize the topic of the project work at the beginning of the third semester.

3. Each theory paper is supposed to cover minimum 60 clock hours (15 clock hours per unit) of teaching and 240 clock hours per semester for all the four papers.

4. One credit course of theory will be of one clock hour per week of 25 marks running for 15 weeks and four credit course of theory will be four clock hours per week of 100 marks running for 15 weeks.

5. One credit course of practical will consist of two clock hours and of laboratory exercise of 25 marks running for 15 weeks and four credit course of practical will consists of eight hours of laboratory exercise marks running for 15 weeks.

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APPENDIX A

M.Sc. Biochemistry Syllabus (Semester Pattern): Consolidated Scheme

Class	Semester	Course Code	Name of Paper	Clock hour /wk	Credits	Maximum Marks		Minimum Passing Marks
						External Marks	Internal Marks	
M.Sc. I Biochemistry	Semester1	BCH1T001	Biophysical Techniques	4 L/wk	4	100		40
		BCH1T002	Protein Biochemistry	4 L/wk	4	100		40
		BCH1T003	Advanced Enzymology	4 L/wk	4	100		40
		BCH1T004	Plant Biochemistry	4 L/wk	4	100		40
		BCH1LAB1	Analytical Biochemistry and Enzymology	8 L/wk	4	80	20	40
		BCH1LAB2	Plant Biochemistry	8 L/wk	4	80	20	40
		BCH1INT1	Internal Assessment (Seminar)	2 L/wk	1		25	10
			Total	34	25	625	65	250
M.Sc. I Biochemistry	Semester2	BCH2T005	Cellular and Molecular Immunology	4 L/wk	4	100		40
		BCH2T006	Cell and Molecular Biology Techniques	4 L/wk	4	100		40
		BCH2T007	Clinical Biochemistry	4 L/wk	4	100		40
		BCH2T008	Molecular Biology	4 L/wk	4	100		40
		BCH2LAB3	Cell and Molecular Biology	8 L/wk	4	80	20	40
		BCH2LAB4	Clinical Biochemistry	8 L/wk	4	80	20	40
		BCH2INT2	Internal Assessment (Journal Club)	2 L/wk	1		25	10
			Total	34	25	625	65	250
M.Sc. II Biochemistry	Semester3	BCH3T009	Advanced Molecular Biology	4 L/wk	4	100		40
		BCH3T010	Biotechnology	4 L/wk	4	100		40
		BCH3T011	Immunobiology	4 L/wk	4	100		40
		BCH3T012	Biochemical & Environmental Toxicology	4 L/wk	4	100		40
		BCH3LAB5	Biotechnology and Immunological Techniques	8 L/wk	4	80	20	40
		BCH3LAB6	Biochemical & Environmental Toxicology	8 L/wk	4	80	20	40
		BCH3INT3	Internal Assessment (Pre Project Presentation for approval)	2 L/wk	1		25	10
		Total		34	25	625	65	250
M.Sc. II Biochemistry	Semester4	BCH4T013	Advanced Clinical Biochemistry	4 L/wk	4	100		40
		BCH4T014	Cell Biology and Cellular Biochemistry	4 L/wk	4	100		40
		BCH4T015	Nutrition and Biochemistry of Movement	4 L/wk	4	100		40
		BCH4T016	Biostatistics, Research Methodology, Technical Writing, Computers and Bioinformatics	4 L/wk	4	100		40
		BCH4LAB7	Biostatistics, Bioinformatics and Cell Biology	8 L/wk	4	80	20	40
		BCH4PROJ	Project Work	8 L/wk	4	80	20	40
		BCH4INT4	Internal Assessment (Final Project Presentation)	2 L/wk	1		25	10
			Total	34	25	625	65	250
			Grand Total	**136**	**100**	**2500**	**260**	**1000**

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APPENDIX B
MASTER OF SCIENCE (BIOCHEMISTRY)
TWO YEAR (FOUR SEMESTERS) DEGREE COURSE

A) ELIGIBILITY CRITERIA FOR ADMISSION TO M. SC BIOCHEMISTRY SEMESTER PATTERN

As per University Direction No. 14 of 2012, For admission to the M.Sc. Semester I in Biochemistry, a candidate shall have offered Chemistry and Biochemistry as subjects of study and examination at B.Sc. degree.

B) ABSORPTION SCHEME TO M. SC BIOCHEMISTRY SEMESTER PATTERN

1. The candidates who have cleared first year annual pattern examination in the subject shall get admission to third semester directly. However, candidates who are allowed to keep term will not be eligible for admission to third semester unless they clear all the papers and practicals of first year annual pattern examination.
2. While switching over to semester system, the failure students of annual pattern will be given not more than three chances to clear the examination.
3. To get admission in the third semester, the student must clear the first semester examination, both in theory and practicals.

C) PATTERN OF QUESTION PAPER

1. Question paper will consist of five questions.
2. Four questions will be on four units with internal choice.
3. Fifth question will be compulsory with question from each of the four units having equal weightage and there will be no internal choice.
4. Maximum marks of each paper will be 75.
5. Each paper will be 03 hours duration.
6. Projects shall be evaluated by both internal and external examiners. 50% marks of project shall be given by internal and external examiner each.
7. Practlical/laboratory examination of 90 marks. Distribution of marks shall be 45 marks internal and 45 marks external.
8. Minimum passing marks in each head (i.e. Theory, Practical and Internal Assessment) will be 40%.

D) GRADE POINT AVERAGE (GPA) AND COURSE GRADE POINT AVERAGE (CGPA)

On clearing a paper, based on the cumulative score (out of 100) in that paper, a student will be given Grade Point Average (GPA) (Maximum of 10, and minimum of 4) for that paper on the following basis.

SCORE (out of 100)	GRADE POINT AVERAGE (out of 100)
90 to 100	10
80 to 89	09
70 to 79	08
60 to 69	07
55 to 59	06
50 to 54	05
40 to 49	04
Below 40	00 or fail

On clearing all the papers in a semester, a student will be allotted a Semester Grade Point Average (SGPA) for that particular semester. As the pattern given above does not have differential weights for papers, the SGPA of a student for a particular semester will be the average of the GPA's for all the papers.

A student will be allotted a Course Grade Point Average (CGPA) after clearing all the four semesters. Again as there is no differential weight system for semesters; the CGPA of a student will be the average of the four SGPA's of that student.

The CGPA can be converted to the usual/conventional divisions in the following way:

CGPA	Equivalent class/division
9.00 to 10.00	First class (outstanding)
8.00 to 8.99	First class (excellent)
7.00 to 7.99	First class with distinction
6.00 to 6.99	First class
5.50 to 5.99	Higher second class
5.00 to 5.49	Second class
4.00 to 4. 99	Pass class
Below 4.00	Fail

APPENDIX C
MASTER OF SCIENCE (BIOCHEMISTRY)
TWO YEAR (FOUR SEMESTERS) DEGREE COURSE

EXPERIMENTAL PROJECT WORK
SCHEME/GUIDELINES FOR THE STUDENTS, SUPERVISORS AND EXAMINERS

Candidates are required to submit an Experimental Project Work on Biochemistry or a related topic of Life Sciences.

The Experimental Project Work will be evaluated by both the internal and external examiner. The Project work will carry a total of 90 marks. Every candidate shall submit two copies of the Experimental Project Work (typed and properly bound) at least one month prior to commencement of the final Practical/ Laboratory Examination of M. Sc II (i.e. IVth Semester) through Head of the Department along with the certificate signed by the supervisor/guide and declaration by the candidate that the work is not submitted to any University or Organization for the award of the degree.

The supervisors for the Experimental Project Work shall be from the following:

A person selected by the duly constituted Selection Committee in the relevant subject and approved by the University, exclusively for PG Course.

OR

A person selected by the duly constituted Selection Committee of the University, and approved by the University, and appointed as a full time regular teacher at UG level in the relevant subject and having atleast 15 years teaching experience.

OR

A person selected by the duly constituted Selection Committee of the University, and approved by the University, and appointed as a full time regular teacher at UG level having M. Phil degree in the relevant subject with 10 years teaching experience at UG level, or a person who has a Ph.d degree with 05 years teaching experience in the relevant subject.

OR

Scientists of National Laboratories/ Regional Research Laboratories with a minimum Grade Pay of Rs. 8000/- and above and who are approved by the Union Government/ the State Government/ Nagpur University/ Other Universities recognized by UGC.

Students will be assigned the topic for the Experimental Project Work by their supervisors. Topics of Experimental Project Work shall be forwarded to Controller of Examination for the appointment of External Examiners. Experimental Project Work shall be evaluated by both external and internal examiner in the respective Department.

The examiners will evaluate the Experimental Project Work taking into account the following considerations:

1. Relevance of the topic
2. Innovations
3. Presentation of work
4. Reference work

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M. Sc. I
SEMESTER I

BCH1T001: BIOPHYSICAL TECHNIQUES

Unit I: Characterization of macromolecules: hydrodynamic techniques
Viscosity, Diffusion, Sedimentation, X-ray Diffraction, Optical Rotatory Dispersion, Circular Dichroism, Molecular weight analysis

Unit II: Characterization of macromolecules: spectrophotometric techniques
Infra red (IR), Electron Spin Resonance (ESR), Nuclear Magnetic Resonance (NMR) and Fluorescence Spectrophotometry, Rayleigh and Raman Scattering.

Unit III: Electrophoresis
Migration of Ions in an electric field, factors affecting mobility, types of electrophoresis-Free and Zonal, General techniques of zonal electrophoresis, Specialized electrophoretic techniques- DISC, Gradient, High Voltage Electrophoresis, Isoelectric focusing, 2D electrophoresis, Immunoelectrophoresis, Pulse Field Gel Electrophoresis, Di-electrophoresis.

Unit IV: Mass Spectrometry
Basics of Mass Spectrometry, Ionization mechanisms- protonation, deprotonation, cationization, transfer of charged molecules to gas phase, electron ejection, electron capture, Mass analyzers-TOF, Ion trap, Quadrupole, Ionization methods-Electron Impact (EI), Chemical Ionization (CI), Fast Atom Bombardment (FAB), Field Description (FD), Electron Spray Ionization (ESI), Matrix Assisted Laser Desorption Ionization (MALDI), Protein Identification using MS.

Suggested References:

1. Principles of Physical Biochemistry- Kensl.E. van Holde, W. Curtis Johnson, P. Shing Ho, Pearson Prentice Hall, 2nd Edition.
2. Crystallography made crystal clear, 1993. G. Rhodes. Academic Press.
3. Principles and Techniques of Biochemistry and Molecular Biology, 6th Edition, Wilson Keith and Walker John (2005), Cambridge University Press, New York.
4. A textbook of biophysics, R. N. Roy, New Central Publication, 1st edition.
5. Chemistry of Organic Natural Products- O. P. Agrawal
6. Organic Biochemistry- I. L. Finar
7. Biophysical Techniques- Upadhyay, Upadhyay and Nath
8. Di-electrioophoresis-Nikhilesh Kulkarni and Jeetendra Dalal (Google e-Book)

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BCH1T002: PROTEIN BIOCHEMISTRY

Unit I: Proteins
Overview of protein structure, protein folding, Ramchandran plot, domains and modules, binding sites within proteins, protein sequencing.

Unit II: Protein biosynthesis
Eukaryotic translation machinery, structure and assembly of the ribosome, initiation, elongation and termination of translation.

Unit III: Protein sorting and degradation
Intracellular protein sorting, movement of proteins between cellular compartments: gated, transmembrane and vesicular transport. Protein transport and translocation to nucleus, mitochondria, chloroplast, peroxisomes, endoplasmic reticular system. Protein degradation.

Unit IV: Protein Engineering
Design and construction of novel proteins and enzymes, Conformation of proteins in general and enzymes in particular, Effect of amino acids on structure of proteins, Energy status of a protein molecule, Structure function relations of enzymes, Physical methods such as x-ray crystallography for determination of protein structure, Site directed mutagenesis for specific protein function, Basic concepts for design of a new protein/enzyme molecule, Specific examples of enzyme engineering, -Dihydrofolate reductase and Subtilisin.

Suggested References:

1. Modern Protein Chemistry: Practical Aspects Published: September 12, 2001 by CRC Press - 272 Pages Edited By: Gary C. Howard
2. Biochemistry. 5th edition. Berg JM, Tymoczko JL, Stryer L. New York: W H Freeman; 2002
3. Proteins: Structures and Molecular Properties: Thomas E. Creighton Publisher: W. H. Freeman 1992 Edition: Second Edition
4. Protein Engineering Protocols (Methods in Molecular Biology) Kristian Müller (Editor), Publisher: Humana Press; Softcover reprint of hardcover 1st ed. 2007 edition (November 10, 2010)
5. Protein Degradation Series, 4 Volume Set (v. 1) R. John Mayer (Editor), Publisher: Wiley-VCH; 1 edition (March 4, 2008)
6. Structural Aspects of Protein Synthesis Anders Liljas (Author) Publisher: World Scientific Pub Co Inc; 1 edition (November 2004)
7. Protein Targeting, Transport, and Translocation Ross Dalbey (Editor), Publisher: Academic Press; 1 edition (May 13, 2002)

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BCH1T003: ADVANCED ENZYMOLOGY

Unit I: Kinetics and Regulation of enzyme activity
Review of unisubstrate enzyme kinetics, multisubstrate enzyme kinetics, Co-operativity phenomenon, Hill and Scatchard plots, protein-ligand binding and its measurement, detailed mechanism of catalysis of serine protease, carbonic anhydrase, and PEP kinase, Metalloenzymes

Unit II: Allosteric enzymes and multienzyme systems
Allosteric enzymes, sigmoidal kinetics and its physiological significance, symmetric and sequential modes of action and their significance, immobilized enzymes and their industrial applications, study of multienzyme complexes with respect to occurrence, isolation and their properties and polygenic nature eg. pyruvate dehydrogenase and fatty acid synthase.

Unit III: Enzyme regulation
General mechanisms of enzyme regulation: Feed back inhibition and feed forward stimulation, repression and induction of enzymes, reversible and irreversible covalent modifications of enzymes, flexibility and conformational mobility of enzymes, convergent and divergent evolution of enzymes.

Unit IV: Bioenergetics and oxidative phosphorylation
Energy transformation, laws of thermodynamics, Gibbs energy, free energy change, redox potentials, phosphate potential, ion electrochemical potential, proton electrochemical potential, membrane potential, Chemi-osmotic theory, mitochondrial respiratory chain, order and organization of carrier proton gradients, Characterization of Iron- Sulphur proteins and Cytochromes, Q cycle, Respiratory controls and oxidative phosphorylation, ATP synthase complex.

Suggested References:

1. Enzymes: Biochemistry, Biotechnology and Clinical Chemistry-Trevor Palmer
2. Principles of Biochemistry- Lehninger, David L. Nelson and Michael M. Cox
3. Enzymes- Malcolm Dixon and Edwin Webb
4. Harper's Biochemistry- Harper
5. Biochemistry- Western and Todd
6. Cell and Molecular Biology-Gerald Karp
7. Fundamentals of Biochemistry-Donald Voet, Judith G. Voet and Charlotte W. Bratt

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BCH1T004: PLANT BIOCHEMISTRY

Unit I: Plant Cell and Photosynthesis

Structure of plant cell (1). Structure of plant cell membrane and cell wall

Photosynthesis: Structure & function of chloroplast system. Photosynthetic pigments and their functions, Photo system I & II. Photosynthetic electron transport and photophosphorylation

Calvin cycle(C3 plants), Hatch slack pathway (C4 plants), Crassulacean acid metabolism.

Unit II: Plant tissue culture and hormones

Plant tissue culture: Plant cell organs and embryo culture, anther culture, somaclonal variation, protoplast isolation, fusion and culture of protoplasts, Application of plant tissue culture.

Plant hormones: Biosynthesis, structure and biochemical mode of action of auxins, gibberellins, cytokinins, abscisic acid and ethylene. Other plant growth regulators.

Unit III: Plant Respiration and Metabolism

Plant respiration: Cyanide sensitive and insensitive respiration.

Nitrogen metabolism: Development and structure of root nodules, Role of nod factors in nodule development. Structure of plant nitrogenase system, Symbiotic nitrogen fixation and its regulation. Formation and assimilation of ammonia

Sulphur metabolism Sulphate activation, Reduction of active sulphate, Oxidation of inorganic sulphur, incorporation of sulphur into amino acids.

Unit IV: Biochemistry of Plant growth

Biochemistry of seed development, dormancy, biochemical changes during germination of seeds. Biochemistry of fruit development and ripening

Structure and function of phytochrome, hormonal regulation of flowering, photoperiodism, and vernilization

Suggested References:

1. Plant physiology -Taiz & Ziger
2. Biochemistry and molecular Biology of plant-Buchanan
3. Plant physiology -M. Devlin
4. Plant pathology- George N. Agriose
5. Plant breeding- B.D. Singh
6. Germination of seed- A.M .Mayer & A. Mayber
7. Introduction of Plant Physiology -William Hopkins
8. Introduction to plant - Godwin & merser
9. Plant physiology - Mohit Warma

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BCH1LAB1: ANALYTICAL BIOCHEMISTRY AND ENZYMOLOGY

1. Estimation of protein by UV Spectrophotometer by E_{280}/E_{260} method
2. Estimation of Riboflavin by Arnold's fluorimetric method
3. Estimation of Thiamine by thiochrome method
4. Demonstration of dialysis using blood filtrate (Protein Seperation)
5. Separation of proteins by PAGE
6. Seperation of proteins by SDS gel electrophoresis
7. Western Blotting
8. Purification of proteins by isoelectric precipitation
9. Molecular weight determination
10. Fractionation of cells by differential centrifugation
11. Assay of marker enzymes
12. To study the essentiality of co-enzymes in enzyme catalyzed reaction
13. Fractionation of human plasma proteins by precipitation
14. Assay of acid and alkaline phosphatase
15. Effect of environmental factors such as pH, temperature and inhibitors on alkaline phosphatase.
16. Measurement of initial velocity
17. To study kinetics of enzyme using Lineweaver-Burk, Eadie-Hofstee and Hanes Plots

BCH1LAB2: PLANT BIOCHEMISTRY

1. Absorption of water by live & dead seeds.
2. Changes in carbohydrate, protein content during germination.
3. Induction of proteinases, amylases, and lipase during germination.
4. Induction of vit. C synthesis during germination.
5. Isolation and characterization of trypsin inhibitor.
6. Assay of peroxidase, catalase, phenol oxidase, ascorbic acid oxidase.
7. Isolation of plant DNA & RNA.
8. Estimation of carotene, ascorbic acid, phenols and tannins in fruits and vegetables.
9. Development of callus culture from meristems and leaves.

BCH1INT1: INTERNAL ASSESSMENT: SEMINARS

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M. Sc I
SEMESTER II

BCH2T005: CELLULAR AND MOLECULAR IMMUNOLOGY

Unit I: The Immune system, Immunoglobulins and TCR

History of Immunology, Innate Immunity: effector mechanisms involved; PAMPs, PRRs, Phagocytosis, Lysis, blocking , extra cellular killing etc . Biochemistry and biology of TLRs, Inflamatory processes, inflamamasomes interrelationship between innate and adaptive immunity.

Immunoglobulins and TCR

Immunochemistry: Antigen antibody reaction, its kinetics and thermodynamics; Structure, functions of immunoglobulins; Ig genes and their expression, Generation of Ab diversity. BCR, TCR, Organization and re-arrangement of TCR genes, TCR diversity.

Unit II:

Anatomy of Immune system

Immunological cells, tissues and organs. Maturation, activation and differentiation of B and T cells. MHC genes and their polymorphism, Structure and function of MHC molecules. Clonal selection theory Cell surface molecules : Ig super family, integrins , selectins , chemokine receptors and other accessory molecules
Cytokines and chemokines

Unit III:

Immune response by T and B lymphocytes

Cellular and molecular mechanisms of Ab production, humoral and cell mediated immunity, Antigen processing and presentation, T and B cell interaction. Super antigens.

Unit IV:

Immunological Techniques

Immunochemical techniques including immunodiffusion, RIA, EIA, agglutination, immunoflorescence, immunoelectron microscopy, immunoelectrophoresis. HLA typing, leukocyte migration inhibition technique, delayed hypersensitivity technique, cytotoxicity assay.
Monoclonal Ab's, hybridoma and other technologies, Abzymes

Suggested References:

1. Cellular and Molecular Immunology- 5th Edition, Abul K. Abbas, Andrew Litchman
2. Immunology-5th Edition, Richard A Goldsby, Thomas J. Kindt, Barbara A Osborne, Janis Kuby
3. Immunology- 6th Edition, Ivan Roitt, Jonathan Brostoff, David Male

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BCH2T006: CELL AND MOLECULAR BIOLOGY TECHNIQUES

Unit I: Flow cytometry

Principles of flow cytometry, Instrument overview, principle of fluorescence, sample preparation, data analysis and applications of flow cytometry

Unit II: Animal cell culture techniques

Animal cell Culture: Cell culture (adherent and suspension), basic equipment, cell culture media- Components, sterility, buffering capacity, growth requirements, supplementation of serum antibiotic and antimycotic agents, preparation of medium, advantages and limitations of Primary cell culture clonal cell lines, basic technique a of animal cell, subcultuing disaggregation, method for quantitation of cells in culture, counting chamber, counters, cell viability determination, cytotoxicity assay and its applications, cell apoptosis assay and its applications, 3 D cultures.

Unit III: DNA techniques

Isolation, Sequencing, Restriction Nucleases, Gel Electrophoresis, DNA probes
Nucleic acid hybridization: Southern blotting, DNA fingerprinting and DNA typing DNA Library
DNA sequencing: Sanger and Maxam Gilbert,
Restriction Mapping, DNase foot printing, DMS foot printing, knockouts
PCR: RFLP, RAPD, AFLP, SNP

Unit IV: RNA techniques

Isolation, Hybridization, Northern Blotting, *in vitro* labeling with radioisotopes and chemical markers,
Mapping and quantifying transcripts: S1 assay, primer extension, run off transcription
Transcription rate measurement *in vivo:* Nuclear run on transcription, reporter gene transcription.
si RNA technology/ gene silencing techniques, its applications, micro arrays, ribozyme technology.

Suggested References:

1. Molecular Biology of the Cell: Alberts 5th Edition 2007 NCBI Publication
2. Principles of Biochemistry: Lehninger WH Freeman
3. Biochemistry of Signal Transduction and Regulation - Gerhard Krauss Wiley VCH 3rd Revised Edition
4. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company
5. The cell: Cooper 2nd Edition ASM Press
6. Gene IX: Benjamin Lewin Published by Pearson Prentice Hall
7. Cell and Molecular Biology: Gerald Karp
8. Molecular Biology: Robert Weaver 1st Edition, WCB McGraw-Hill
9. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
10. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated , Taylor & Francis, 2005

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BCH2T007: CLINICAL BIOCHEMISTRY

Unit I: Automation in clinical biochemistry, gastric and blood disorders

Automation in Clinical Biochemistry- Instrumental concept, Selection of Instrument, Quality assurance, Control of pre-analytical and analytical variables, External and internal quality control measurements.

Good Clinical Practices: Basics and principles

Gastric disorders: Disorders of gastric function, method of evaluation, pancreatic diseases, Steatorrhoea, Malabsorption syndrome test for their evaluation.

Blood Disorder: Review of mechanism of coagulation and fibrinolysis, abnormalities in blood coagulation, variation of plasma proteins, abnormalities of blood formation, anemia, haemoglobinopathies, clinical significance of fecal and urine analysis.

Unit II: Endocrinology I

Insulin and glucagon: Various types of hyperglycemia, Diabetes mellitus Ketonemia ,ketonuria , Experimental diabetes , Hypoglycemia, Polyurea, Glucose tolerance test.

Thyroid: Iodine metabolism, Hypo and Hyper thyroidism, B.M.R.and other test for evaluation of thyroid function.

Parathyroid: Calcium and phosphorus metabolism. Abnormalities of Parathyroid function and methods of evaluation.

Unit III: Endocrinology II

Adrenal: Addison's disease and pheochromocytoma, Disorders of steroid metabolism, Test for evaluation of adrenal functions.

Pituitary: Pituitary hormones, Clinical syndromes and their evaluation.

Unit IV: Liver disorders

Liver disorders: Jaundice, fatty liver and liver function tests. Renal function test

Cerebrospinal fluid: Composition in health and disease .Lipid profile in health and disease.

Elements of Clinical Enzymology: Isoenzymes in health and disease.

Clinical significance of GOT, GPT, Creatine kinase, LDH etc.

Biochemical diagnosis of disease by enzymatic evaluation.

Suggested References:

1. Clinical Biochemistry – Metabolic and Clinical aspects By-William J. Marshall & Stephen K. Angert.
2. Harper's Biochemistry - 27th Ed.
3. Text book of Medical Physiology - By Guyton.
4. Text book of Physiology -By Burn & levy.
5. Biochemistry –By L .Stryer (Freeman & Co.NY.)
6. Biochemistry with clinical correlation- By Thomas Devli.
7. The Metabolic Basis of Inherited Disease 5th Ed.-By John Stanbury.
8. Teitz Fundamentals of Clinical Chemistry –By C.A.Burtis & Ashwood .
9. Biochemistry - By Lehninger.
10. Lehninger's Biochemistry –By Nelson & Cox.
11. Biochemistry –By Stanford.
12. Basic Medical Biochemistry: A Clinical approach- By Smith.
13. Principles of Internal Medicines- By Harrison.T. R.
14. Practical Biochemistry Principles & Techniques- By Wilson & Walker.
15. Practical Biochemistry –By David Plummer.

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BCH2T008: MOLECULAR BIOLOGY

Unit I: Eukaryotic and Prokaryotic chromosomes
Structure of prokaryotic Chromosomes
Structure of eukaryotic chromosomes
DNA content, banding pattern, c-value, complexity heterochromatin, centromere, nuclear organizer, telomeres
Kinetic complexity, of DNA, cotcurve, classes of DNA sequences
Histones, Nonhistone proteins, and their properties, structure of nucleosome, role of histones in chromatin folding, concept of gene

Unit II: Replication and Recombination
Replication: Review of replication in bacteria, plasmid and viruses, Models of DNA replication.
DNA replication in eukaryotes. Eukaryotic DNA polymerases and their roles, origin of replication, Autonomously Replicating Segments (ARS) in yeast, elongation, lagging strand synthesis, and termination.
Recombination: DNA recombination: Homologous, site specific and transposition,
Homologous recombination: Holliday Model, Messelsson -Radding Model, Rec BCD pathway.
Site specific recombination: Lambda phage ingration, and excision rearrengement,of immunoglobulin genes.
Transposition: Prokaryotic transposition, Insertion sequence,s, and mere complex transposons (eg Tn3), conservative and replicative transposition. Eukaryotic transposable elements,: yeast and Drosophila transposons, retroviruses, and retrovirus like elements.

Unit III: Transcription
Review of prokaryotic transcription, transcription in eukaryotes: Eukaryotic RNA polymerases and their subunit structure, Class I, II and III promoters, Upstream elements, enhancers and silencers, General transcription factors, Class I, II, III genes and their functions elongation factors, TBP structure and its role in transcription, mediators. Structure of transcription activators, zinc fingers, homeodomains, helix loop helix, bZIP, beta barrels.

Unit IV: Viruses
Architecture and Nomenclature: Properties, Structure and Morphology, Baltimore Classification, Laboratory Diagnosis of Viral Diseases: Cytopathic effects and methods, drug susceptibility testing, DNA and RNA viruses: Molecular mechanisms of tumor formation, Prions and Viroids, Bacteriphages: Composition and Structure, Overview of bacteriophage infections, role of bacteriophages in industrial fermentations and biofilm formation.

Suggested References:

1. Molecular Biology of Gene: Watson
2. Gene 7: Benjamin Lewin
3. Cell & Molecular Biology: Devlin
4. Biochemistry: Lehninger, Nelson & Cox
5. Biochemistry: Voet & Voet
6. Molecular Biology: David Frifelder
7. Molecular biology-Lodish, Baltimore.
8. Genetics-Russell.
9. Genetics 1and 2-C.B.Power
10. Molecular biology-Watson
11. Molecular biochemistry -Robert Weaver
12. Microbiology by Davis
13. Virology by Luria
14. Understanding Viruses-Teri Shors, Jones and Bartlett Publishers, Massachusetts, edition 2009.

BCH2LAB3: CELL AND MOLECULAR BIOLOGY

1. Use of Simple, Compound and Phase Contrast Microscopes
2. Cell counting by Hemocytometer
3. Isolation and culture of lymphocytes
4. Trypsinization, cell count, subculturing of adherent cell line
5. MTT assay
6. Isolation of DNA from Bacteria and Blood
7. Assessment of purity of DNA by 260/280 ratio
8. Isolation of plasmid DNA: Mini Prep, Midi Prep and Maxi Prep.
9. Restriction digestion of DNA
10. Ligation of DNA
11. Separation of DNA fragments by Electrophoresis.
12. Southern Blotting & Northern Blotting

BCH2LAB4: CLINICAL BIOCHEMISTRY

1. Determination of serum and urine Creatinine by Jaff's method.
2. Determination of serum Bilirubin by Malloy & Evllyn method.
3. Determination of serum Chloride by Schales & Schales method.
4. Estimation of blood urea by Nesslerisation method.
5. Estimation of Serum amylase (E.C.3.2.1.1).
6. Estimation of Serum Cholesterol by Single Step Method (Libermann & Burchard).
7. Determination of Serum Uric Acid by Henry Caraway's method.
8. Determination of Icteric Index, SGOT, SGPT and alkaline phosphatase activity
9. Routine Urine Analysis.
10. Quantitative Estimation of T3, T4 and TSH
11. To determine Urinary VMA (3-methoxy 4 –hydroxy Vanillin Mandellic Acid).
12. Glucose Tolerance Test.

BCH2INT2: INTERNAL ASSESSMENT: JOURNAL CLUB

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M. Sc II
SEMESTER III

BCH3T009: ADVANCED MOLECULAR BIOLOGY

Unit I: Regulation of eukaryotic gene expression at transcriptional level
Overview of transcription by RNA Polymerases I, II, and III
Anatomy of a protein-coding gene
Basal transcription by RNA polymerase II: Subunits of Pol II; general transcription factors; Activators How the initiation complex is assembled How initiation occurs
Speeding up the process: Enhancers, TAF's and how they work
Regulated transcription: transcription factors: Zinc-fingers (Sp1; the first such factor identified) Leucine zippers, Basic helix loop helix, Homeodomains, DNA binding domains, Activating domains
RNA Elongation: HIV TAT/TAR
RNA polymerase III and regulation of 5S rRNA

Unit II: Regulation of eukaryotic gene expression at translational level
An overview and the elongation cycle, the ribosome as a molecular machine
Initiation and Regulation: Over-view of initiation of translation
Regulation of Translation: Global regulation through eIF2 and eIF4E/eIF4E-BP. Specific regulation through 5' UTRs using RNA structure e.g. ODC. Specific regulation through 5' UTR/protein interactions e.g. ferritin in eukaryotes and ribosomal proteins in prokaryotes. Specific regulation through 3' UTRs e.g. 15-LOX

Unit III: Regulatory RNAs
Historical background, RNA interference as regulatory mechanism in eukaryotes Slicer and dicer, synthesis and function of RNAi molecules in plants, chromatin remodeling in human disease and diagnosis

Unit IV: Epigenetics
Background, chromosomal inheritance taking fission yeast as an example, DNA methyltransferases, DNA methylation maintenance, histone modification and regulation of chromatin structure, bivalent histones, DNA demethylation, histone demethylation

Suggested References:

1. Molecular Biology of the Cell: Alberts 5th Edition 2007 NCBI Publication
2. Principles of Biochemistry: Lehninger WH Freeman
3. Biochemistry of Signal Transduction and Regulation - Gerhard Krauss Wiley VCH 3rd Revised Edition
4. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company
5. The cell: Cooper 2nd Edition ASM Press
6. Genes IX: Benjamin Lewin Published by Pearson Prentice Hall
7. Cell and Molecular Biology: Gerald Karp
8. Molecular Biology: Robert Weaver 1st Edition, WCB McGraw-Hill
9. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
10. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated , Taylor & Francis, 2005

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BCH3T010: BIOTECHNOLOGY

Unit I: Gene control systems in bacteria and bacteriophage lambda:
Mechanism of induction and repression, constitutive expression various control mechanisms, positive regulation, negative regulation, attenuation, operon hypothesis with special reference to mal/gal, ara and histidine operons, Regulatory mechanisms in bacteriophage lambda.
Regulation of gene expression at various levels (transcription, post transcriptional and translational)
DNA-protein interactions: Lambda family of repressor, trp repressor.

Unit II: rDNA technology
Genomic and cDNA libraries, DNA manipulation enzymes, isolation of specific genes.
Gene cloning: REs, vectors-plasmids, cosmids phage vectors, M13 phage vectors, phagemids expression vectors with strong promoters, inducible, vectors produce fusion proteins and their isolation, Eucaryotic expression system, shuttle vectors, YAC, BAC insertion of DNA and its ligation to carrier DNA, introduction of DNA in cells, gene synthesis, gene libraries.
Application of recombinant DNA technology in medicine, agriculture industry and environmental sciences.

Unit III: Biochemical engineering
Biochemical Engineering: Bioreactors and related equipment and instrumentation, types of bioreactor (Batch, semi batch, CSTF, recycle etc), reactor analysis, reactor design, reactor for recombination proteins.

Unit IV: Fermentation technology
Fermentation technology, microbial culture reaction, genetic modification, use of mutants, recombinant DNA technology and application in fermentation technology, microbial growth kinetics, sterilization, fermentation process kinetics, analysis of rate pattern and kinetic groups, fermentation process types, control of environmental variables, recovery of fermentation products, isolation and purification and use of immobilization techniques.

Suggested References:

1. Molecular Biology of the Cell: Alberts 5th Edition 2007 NCBI Publication
2. Principles of Biochemistry: Lehninger WH Freeman
3. Biochemistry of Signal Transduction and Regulation - Gerhard Krauss Wiley VCH 3rd Revised Edition
4. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company
5. The cell: Cooper 2nd Edition ASM Press
6. Genes **IX**: Benjamin Lewin Published by Pearson Prentice Hall
7. Cell and Molecular Biology: Gerald Karp
8. Molecular Biology: Robert Weaver 1st Edition, WCB McGraw-Hill
9. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
10. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated , Taylor & Francis, 2005
    Molecular Biotechnology: Principles and Applications of Recombinant DNA Bernard R. Glick(Author),Publisher: Amer Society for Microbiology; 4 edition (December 31, 2009)
11. Principles of gene manipulation and genomics S. B. Primrose, Richard M. Twyman Publisher: Wiley-Blackwell; 7 edition (February 17, 2006)
12. Principles of Fermentation Technology, P. F. Stanbury (Author), S. Hall (Author), A. Whitaker (Author) Publisher: Butterworth-Heinemann; 2 edition (February 19, 1999)

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BCH3T011: IMMUNOBIOLOGY

Unit I: Introductory Immunobiology

Complement system: Alternative and Classical pathway of complement activation

Immune networks: Homeostasis in the immune system-termination of normal immune responses, network hypothesis

In vivo immunity to viruses, bacteria, fungi, protozoa, worms etc

Unit II: Immunological tolerance and Autoimmunity

Immunologic tolerance, T lymphocyte tolerance- central and peripheral, Apoptosis in Lymphocytes-pathways and biochemical mechanisms, effector mechanisms, Tolerance induced regulatory T cells, B lymphocyte tolerance- Central and Peripheral, Homeostasis in the immune, pathogenesis and therapeutic approaches to autoimmunity.

Unit III: Tumor and Transplantation Immunology, Hypersensitivity

General features of tumor immunity, tumor antigens, Immune response to tumor and evasion, Immunotherapy, Types of hypersensitivity, Effector mechanisms of immunologic tissue injury and disease.

Unit IV: Immunodeficiency and Vaccinology

MHC and disease susceptibility, immune deficiency disorders, Active immunization (immune prophylaxis), passive immunization, adjuvants, modern approaches to vaccine development, role of vaccines in the prevention of disease.

Suggested References:

1. Cellular and Molecular Immunology- 5th Edition, Abul K. Abbas, Andrew Litchman
2. Immunology-5th Edition, Richard A Goldsby, Thomas J. Kindt, Barbara A Osborne, Janis Kuby
3. Immunology- 6th Edition, Ivan Roitt, Jonathan Brostoff, David Male

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BCH3T012: BIOCHEMICAL AND ENVIRONMENTAL TOXICOLOGY

Unit I: General principles of Toxicology

Definition, Different facets of toxicology and their interrelationships, Classification of toxic agents. Desired and undesired effects.

Various factors affecting toxicity: vehicles, formulation factors, biological half life, volume and concentration, dose, dosage forms, routes of administration / entry, genetic status etc.

Principles of selective toxicity: comparative morphology, comparative biochemistry, comparative cytology.

Toxicity assessment: acute, subchronic, chronic exposure, determination of ED50 and LD50 values, tests for mutagenecity, carcinogenicity, genotoxicity, Ames test.

Unit II: Disposition of Toxicants

Factors affecting disposition of toxicants: absorption, distribution, biotransformation, elimination.

Absorption through gastro-intestinal tract, lungs, skin.

Distribution: storage in tissues, blood-brain barrier, passage across placenta, redistribution.

Biotransformation, Phase I and II reactions, metabolic interrelationship, antidotal therapy.

Excretion: urinary, fecal, exhalation, other routes.

Toxicokinetics: classic and physiologic.

Unit III: A) Non –organ directed toxicity

Chemical carcinogenesis: definition, mechanism.

Genetic toxicology: definition, health impacts and mechanism of induction of genetic alterations.

Developmental toxicology: definition, principles, mechanism and pathogenesis of developmental toxicity.

B) Environmental Toxicology

Air pollution: definition, air pollutants, health effects and risk assessment of air pollution.

Introduction to Ecotoxicology

Unit IV: Target organ toxicity

Skin: skin as a barrier, dermatitis, acne, urticaria

Toxic responses of the blood: blood as a target organ, toxicology of erythron, leukon and platelets.

Toxic responses of the liver: physiology and pathophysiology, factors in liver injury, mechanism of liver injury.

Toxic responses of the respiratory system: lungs structure and functions, pulmonotoxic agents, pathogenesis of chemical induced damage, acute and chronic responses of lungs to injury.

Suggested References:

1. Casarette and Doull's Toxicology by Klaassen CD
2. Biochemical Toxicology of Environmental Agents by Bruine D.
3. Detoxification mechanisms by Williams RT
4. Selective Toxicity by Albert A.
5. Developmental Toxicology by Hood RD.

BCH3LAB5: BIOTECHNOLOGY AND IMMUNOLOGICAL TECHNIQUES

1) Fermentation
    i) Isolation of microorganisms from soil demonstrating synthesis capability of desired product, Gram staining (Desired property to be decided by the instructor), and screening
    ii) Optimization of the lab scale production of the desired product: Effect of temperature, pH, substrate concentration
    iii) Growth curve: Estimation of cell number, substrate utilization and/or product formation.
2) Polymerase Chain Reaction
    i) PCR amplification from genomic DNA
    ii) Nested PCR
    iii) Random Amplification of Polymorphic DNA (RAPD)
3) Restriction Fragment Length Polymorphism (RFLP)
4) Immunology
    A. Quantitative Estimation of Antibody
    B. Precipitation Techniques : Double Immunodiffusion, Single (Radial) Immunodiffusion
5) Electrophoretic Techniques : Immuno-eelectrophoresis, Rocket Immunoelectrophoresis, Immuno-diffusion

BCH3LAB6: BIOCHEMICAL AND ENVIRONMENTAL TOXICOLOGY

1. Qualitative detection of various toxicants in biological samples:
   Phenothiazine derivatives, Organochlorine compounds (Fujiwara test), Phenol, Methanol, Arsenic (As), Antimony (Sb), Selenium (Se), Mercury (Hg), Bismuth (Bi), Fluoride (F), Boron (Bo), Gutzeit test for Antimony (Sb) and Arsenic (As), Spot test for metal toxicants.
2. Quantitative determination of Salicylate, Paracetamol (acetaminophen), Sulphonamide in biological samples.
3. Enzyme assay in toxic conditions:
   GOT (AST), GPT (ALT), Acid phosphatase, Alkaline phosphatase, Acetyl cholinesterase etc.
4. Construction of dose-response curves.
5. Determination of LD50 value of a toxicant.
6. Induction of hepatotoxicity / diabetes / skin lesions / teratogenesis.
7. Organ / tissue morphology / histopathology
8. Assay of toxicant biotransformation enzyme-cytochrome P450.
9. Test for teratogenecity / carcinogenecity / Ames test.
10. Assay of biomarkers of environmental pollution / toxicity.

BCH3INT3: INTERNAL ASSESSMENT: PRE-PROJECT PRESENTATION FOR APPROVAL

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M. Sc II
SEMESTER IV

BCH4T013: ADVANCED CLINICAL BIOCHEMISTRY

Unit I: Aging and Neurological Disorders

Current view and theories of aging, auto immune connection and HLA association, processes of aging and biochemical alteration, DNA damage, protein oxidation and axonal transport in aging, nutritional intervention as anti-aging therapy..

Alzheimer's disease: Causes, symptoms, diagnosis, pathogenesis, genetics, APP, ApoE, PS2, tau protein, risk factors and therapeutic approaches.

Progeria

Parkinson's disease: Causes, symptoms, diagnosis, pathogenesis, genetics and therapeutic approaches

Unit II: Obesity

Theories, lipid metabolism, adipose tissue anomalies.

Genetic basis of familial obesity, effects of neuropeptides and leptin in nutrient partitioning.

Obesity related derangements in metabolic regulation.

Therapeutic approaches

Unit III: Molecular and Metabolic Diseases

Human gene map, genetic diversity, polymorphism, genetic linkage, chromosomal disorder. Monogenetic Disorders: Autosomal dominant, autosomal recessive, X-linked, Multifactorial disorders, Genetic heterogeneity. Allelic heterogeneity, Pathogenesis of genetic disease, Galactosemia, Hemophilia, Sickle cell anemia, Muscular dystrophy, Hypercholesterolemia, Gout, Turner's syndrome.

Unit IV: Reproductive Biochemistry

Overview of reproductive system and reproduction, biochemistry of reproductive disorders (male & female), Influence of various factors in reproduction with special reference to role of prostaglandins and gonadotrophins. Mechanism and methods of birth control and possible biochemical consequences thereof. Biochemical marker's in infertility disorders. Techniques involved in assisted reproductive technology (ART). Culture media and cell culture techniques in ART programme.

Suggested References:

1. Clinical Biochemistry – Metabolic and Clinical aspects By-William J. Marshall & Stephen K. Angert.
2. Harper's Biochemistry - 27th Ed.
3. Text book of Medical Physiology - By Guyton.
4. Text book of Physiology -By Burn & levy.
5. Biochemistry –By L .Stryer (Freeman & Co.NY.)
6. Biochemistry with clinical correlation- By Thomas Devli.
7. The Metabolic Basis of Inherited Disease 5th Ed.-By John Stanbury.
8. Teitz Fundamentals of Clinical Chemistry –By C.A.Burtis & Ashwood .
9. Biochemistry - By Lehninger.
10. Lehninger's Biochemistry –By Nelson & Cox.
11. Biochemistry –By Stanford.
12. Basic Medical Biochemistry: A Clinical approach- By Smith.
13. Principles of Internal Medicines- By Harrison.T. R.
14. Practical Biochemistry Principles & Techniques- By Wilson & Walker.
15. Practical Biochemistry –By David Plummer.

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BCH4T014: CELL BIOLOGY AND CELLULAR BIOCHEMISTRY

Unit I: Cell cycle and regulation
Review of cell cycle, divisional control, regulatory proteins, cyclin/cdk complexes, positive and negative regulation, inhibitory molecules, restriction points, regulation of DNA synthesis, regulation of degradation, check points, cell cycle arrest, role of cyclically activated protein kinases, transcriptional regulation.

Unit II: Cell communication I
General principles of cell communication, extra cellular signals and their receptors, autocrine signaling and role of gap junctions, types of cell receptors, relay of signal and intracellular signal proteins, regulated proteolysis dependent signaling pathways.

Unit III: Cell communication II
Informational transactions in eukaryotic cells- cyclic AMP facet, Study of G-proteins, signaling through G-protein linked cell surface receptors, signaling through enzyme linked cell surface receptors, Calcium messenger system, signaling via GMP.

Unit IV: Cancer
Causes and types of cancer, viral carcinogenesis, tumor suppressors, oncogenes and signal transduction, growth and spread of cancer, molecular basis of cancer therapy, molecular markers.
Programmed cell death and its regulation in normal physiology, regulation and execution of mammalian apoptosis, cytokine signaling and role of apoptosis in tumor genesis.

Suggested References:

8. Molecular Biology of the Cell: Alberts 5th Edition 2007 NCBI Publication
9. Principles of Biochemistry: Lehninger WH Freeman
10. Biochemistry of Signal Transduction and Regulation - Gerhard Krauss Wiley VCH 3rd Revised Edition
11. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company
12. The Cell: Cooper 2nd Edition ASM Press
13. Gene IX: Benjamin Lewin Published by Pearson Prentice Hall
14. Cell and Molecular Biology: Gerald Karp
15. Molecular Biology: Robert Weaver 1st Edition, WCB McGraw-Hill
16. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
17. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated , Taylor & Francis, 2005
18. The Cell- G. M. Cooper

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BCH4T015: NUTRITION AND BIOCHEMISTRY OF MOVEMENT

Nutritional Biochemistry I:

Basic Concept: Energy content of foods. Measurements of energy expenditure: Direct & Indirect calorimetry. Definition of BMR and SDA and factors affecting these. Thermogenic effects of foods. Energy requirements of man and woman and factors affecting energy requirements.

Role of dietary fibers in nutrition.

Clinical Nutrition: Role of diet & nutrition in prevention & treatment of diseases: Dental Caries, Flurosis, Atherosclerosis & Rheumatic disorders .Inherited metabolic Disorders: Phenylketonuria, Maple Syrup disease & Hemocystinuria.

Nutritional Biochemistry II:

Protein Energy Malnutrition (PEM): Aetiology, Clinical features, Metabolic disorders and Management of Marasmus and Kwashiorkor diseases.

Starvation: Techniques for the study of starvation.Protein metabolism in prolonged fasting. Protein sparing treatments during fasting. Basic concept of High protein low caloric weight reduction diets.

Disorders of Mineral Metabolism: Hypercalecemia, Hypocalcaemia, Normocalcemia, Hyperphosphatemia.

Unit III: Cytoskeleton

Microtubules: Actin Filaments, Actin Architectures, The dynamics of Actin Assembly, Myosin-A cellular Engine that powers Motility, Actin and Myosin in Non muscle cells, Cell Motility.

Microfilaments: Microtubules structures, Microtubule Dynamics, Microtubule Associated Proteins, Kinesin, Dynenin and intracellular Transport, Microtubule Dynamics and Motor Proteins during Mitosis, Intermediate Filaments.

Vesicles, the cytoplasm matrix, biochemical dynamics of the cytoskeleton.

Unit IV: Flagella, Cilia and Sperm motility

Cilia and Flagella- Structure and Movement, Amoeboid movement, pseudopod formation, Sperm motility, Cytolasmic streaming , cytoplasmic transport of vesicles.

Suggested References:

1. Text book of Biochemistry & Human Biology – G.P .Talwar
2. Text book of Human Nutrition – M.S.Banerji, N.Pralhad Rao & V.Reddy.
3. Nutrional Biochemistry & Metabolism – Linten.
4. Human Nutrition & Dietics- Davidson & Passmore (ELBS)
5. Modern Nutrition in Health & Diseases – Maurice E Skills & V R Yong.
6. Food & Nutrition – M.S.Swaminathan
7. The Cell – By Cooper.
8. Cell and Molecular Biology – de Robertis & de Robertis.
9. Molecular Biology of the Cell: Alberts 5th Edition 2007 NCBI Publication
10. Principles of Biochemistry: Lehninger WH Freeman
11. Biochemistry of Signal Transduction and Regulation - Gerhard Krauss Wiley VCH 3rd Revised Edition
12. Molecular Cell Biology: Lodish 6th Edition, WH Freeman & Company
13. The cell: Cooper 2nd Edition ASM Press
14. Gene IX: Benjamin Lewin Published by Pearson Prentice Hall
15. Cell and Molecular Biology: Gerald Karp
16. Molecular Biology: Robert Weaver 1st Edition, WCB McGraw-Hill
17. Molecular Biology of the Gene: Watson 6th Edition, Pearson Publication
18. Gene Regulation: A Eukaryotic Perspective: David Latchman 5 illustrated , Taylor & Francis, 2005

BCH4T016: BIOSTATISTICS, RESEARCH METHODOLOGY, TECHNICAL WRITING, COMPUTERS AND BIOINFORMATICS

Unit I: Biostatistics

Statistics in Research: Specific applications of measures of Central tendency, Dispersion, Skewness and Kurtosis in research. Measures of Relationship: Correlation, Simple, Partial and multiple- Regression, Hypothesis Testing and estimation: Fundamentals of hypothesis testing-Standard error point and interval estimates-Important non-parametric tests Parametric Tests: Testing of significance mean, proportion, variance and correlation-Testing for significance of difference between means, proportions, variances and correlation coefficients. ANOVA and Chi-Square Tests: One-way and two-way ANOVA

Unit II: Research Methodology and Technical Writing

Methodology of scientific research, nature of scientific methods, design of experiments, policies in regulating research, guidelines for use of humans and animals in research.

Preparation of scientific report. Thinking and planning, information, ideas, order of paragraph writing, proper use of nouns, pronouns and articles, tenses, spellings etc.

Presentation of review. Objective , design of the experiment, parameters used, data obtained, interpretation, summary.

Unit III: Computers

Introduction of computer networks- Topologies and designs; Basics of computer operating systems-windows and Linux; Introduction to Markup language-Hyper Text Markup Language (HTML) and Extensive Markup Language (XML); Spreadsheets and Presentation software.

Systems Biology-An introduction

Introduction to Metagenomics

Unit IV: Bioinformatics

Introduction to Bioinformatics: Applications of Bioinformatics, Bioinformatics resources

Biological Databases: Overview to Biological Databases, Nucleotide Databases (GenBank, DDBJ, ENA), Protein sequence databases (Uniprot, Swiss prot, Prosite , Pfam, Prodom), Protein structure databases (PDB, SCOP, CATH)

Sequence analysis: Sequence similarity search, BLAST, FASTA, CLUSTAL

Genomics: Introduction to Genomics, Comparative Genomic Databases, Objective of Genome Comparisons, Genome Alignments

Proteomics: Overview of Proteomics, Experimental Techniques, Bioinformatics Approaches, Protein-Protein Interaction, Databases and software

Application of bioinformatics in drug designing

Suggested References:

1. Bioinformatics: A practical guide to the analysis of genes and proteins. Baxevanis A.D and Ovellette B.F.F., Wiley-Interscience, (2002).
2. Molecular and Biotechnology. A comprehensive desk reference, R.A. Meyes (Ed.) VCH Publishers Inc. (1995)
3. Textbook of Biotechnology Das H.K., Wiley Dreamtech India Pvt Ltd, (2004).
4. Principles of Genome analysis and genomics, Primrose SB, Twyman RM, Blackwell Science (2002).
5. Biostatistics-A foundation for Health Science, Daniel WW, John Wiley (1983).
6. Statistical Methods, Medhi J, Willey Eastern Limited, (1992).

BCH4LAB7: BIOSTATISTICS, BIOINFORMATICS AND CELL BIOLOGY

1: Accessing the literature databases for literature survey.
2: Retrieval of sequences from online sequence databases (Plant, bacterial & animal databases)
3: To perform pair wise alignment of sequences using BLAST program.
4: To design primers for the given gene sequences.
5: To perform multiple sequence alignment and generate phylogenetic tree.
6: To retrieve and visualize the three dimensional structures of proteins.
7: To retrieve metagenomic sequences and primer designing to develop STS marker.
8: Downloading atom coordinates from pdb using the co-ordinate file to view the molecules using molecular visualization tools- RasMol, WebLab Viewer, ChemDraw, ISIS Draw, Deep View.
9: Molecular mechanics, energetics, free energy calculations
10: Gene finding programs
11: Biology workbench
12: Introduction to the use of software packages for statistical analysis
13. To assay cathepsin D, ATPase (Na/K/Ca/Mg), Lipid peroxidase enzymes

BCH4PROJ: PROJECT WORK

BCH4INT4: INTERNAL ASSESSMENT: FINAL PROJECT PRESENTATION