GUJARAT UNIVERSITY

Ahmedabad – 380009,

Gujarat, India.

SYLLABUS

(June 2015 as per Revised MPhil Rules, Regulation and Ordinance 2015)

M. Phil.

In

BIOCHEMISTRY

GUJARAT UNIVERSITY

DEPARTMENT OF BIOCHEMISTRY,

University School of Sciences

Ahmedabad – 380009, Gujarat, India.

M. Phil. in Biochemistry

The recent advances in biological Sciences have proved that the present training is inadequate for any meaningful research in present scenario, as all living systems are directly and indirectly interdependent. Interdisciplinary and integrated approach is very necessary for any significant contribution in modern Sciences in general and in Life Sciences in particular. Hence the course which was started in 1982 with same aim, revised regularly according to latest developments and discoveries, which will impart a broad training in various disciplines of Life Sciences, so that a student passing this course will be well equipped to meet challenges of academic and research of Life Sciences. These students will be able to pursue careers in pharmaceutical industries, research laboratories, clinical research organizations, school, colleges and Universities.

M. Phil. Syllabus (Effective from June 2015):

1. There shall be four papers each of four hours (3+1) duration and dissertation.
2. The major emphasis of this Course is to motivate students for improvement through regular internal assessment. They should be encouraged for self study and seminar according to allotted times of the course per week.
3. Each theory paper is divided into five units. Each unit will have equal weightage of teaching and while setting question paper.
4. Question or its sub question including the options will be set from the same unit.
5. The elective papers will be offered as per availability of the expert faculty and feasibility of the department and schedule of teaching.
6. There shall be at least one study tour during the span of two years of P.G. study, pertaining to different Life Sciences/ Microbiological/ Environmental/ Biotechnological/ Pharmaceutical industries/ research institutes/ various ecosystems, even outside Gujarat State. The study tour is highly essential for study various concepts, processes and technology pertaining to Life Sciences.

Course No.	Course Name	Hours Per Week	Credits	Marks		
				Internal	External	Total
BCH 601	Research Methodology	60	4	30	70	100
BCH 602	Recent Advances in Biochemistry	60	4	30	70	100
BCH 603	Molecular Biology and Biotechnology	60	4	30	70	100
BCH 604	Practical / Projects / Experiments / Field Work / Seminar / Review	60	4	100		100
BCH 605	Dissertation		8		140 + 60	200
	Total		**24**	**190**	**410**	**600**

M. Phil Syllabus

BCH (PAPER-I): RESEARCH METHODOLOGY: **(100=70+30 Marks)**

(Computer Skill, Writing of Research Proposal and Project)

UNIT – I: Research Methods

- *Introduction*: Meaning, objectives and types of research, significance of research. Definition and identification of a research problem, justification, theory of hypothesis.
- *Research Design*: Features of a good design, concepts of variables, experimental and control groups. Hypothesis testing.
- *Reporting:* Significance of report writing, steps in report writing and types of reports, Writing of research proposal.

UNIT – II: Spectroscopy and Separation Techniques

- *Centrifugation*: Preparative and Analytical Centrifuge, Ultracentrifugation
- *Spectroscopy:* U.V., I.R., Atomic absorption and Mass spectroscopy, MALDI - PAGE
- *Electrophoresis:* SDS-PAGE, 2-D gel electrophoresis, Agarose gel electrophoresis,
- *Chromatography*: Types of Column Chromatography, HPTLC, GC, HPLC

UNIT – III: Radio Active Labelling and Molecular Biology Techniques & Microscopy:

- Tracer based techniques: RIA, IRMA, ELISA, Autoradiography, PCR and its variations
- Various Blotting techniques, RFLP, RAPD, AFLP, FISH, M-FISH,
- PET, CAT, Micro CT, MRI
- Phase Contrast Microscopy, DIC, Fluorescence Microscopy, Confocal Microscopy,
- TEM, SEM, STEM , Special Techniques
- Flow cytometry

UNIT – IV: Bioinformatics and Biostatistics:

- Biological database, Proteomics, Genomics
- Applications of Bioinformatics
- Mean, Median and Mode
- Standard Error and Standard deviation
- T-test, Chi-square test (x2), Regression
- Variance and Co-variance, ANOVA
- Sampling distribution, Probability distribution (Binomial, Poisson & Normal)
- Difference between parametric &nonparametric statistics

BCH 602 (Paper – II): RECENT ADVANCES IN BIOCHEMISTRY: **(100=70+30 Marks)**

UNIT – I: Cell Culture:

- **Animal Cell Culture**

- Laboratory, equipment's & conditions for animal cell culture
- Establishment of primary cell culture (Measurement of viability and cytotoxicity, growth parameters)
- Culture media for animal cell culture and their requirements
- Cell synchronization of animal cells & characterization

- **Plant Tissue Culture**

- General technique, nutrient medium and requirements
- Callus and suspension culture
- Cloning and regeneration
- Transgenic plants
- Secondary metabolites

UNIT – II: Enzymology:

- Conformation of proteins (Ramachandran plot , secondary, tertiary and quaternary structure,domains,motifs and folds)
- Principle of catalysis
- Enzyme and enzyme kinetics
- Enzyme regulation
- Mechanism of enzyme catalysis

UNIT – III: Bioenergetics:

- Glycolysis
- Oxidative phosphorylation
- Coupled reaction
- Group transfer
- Biological energy transducers
- Photophosphorylation
- ETS microsomal

UNIT – IV: Cell Signaling, Immunology & Microbial Techniques:

- G protein couple receptor and its regulation
- Secondary messengers
- Mechanism of signal transduction
- Microbial fermentations-organic acid (citric acid), amino acid (glutamic acid)
- Types of fermentors
- Genetic basis of antibody diversity and antibody engineering
- Clonal selection
- Immune response-MHC, HLA compatibility
- Monoclonal and polyclonal antibody

BCH 603 (Paper – III): MOLECULAR BIOLOGY & BIOTECHNOLOGY: (100=70+30 Marks)

UNIT – I: Fundamental Molecular Processes:

- **DNA Replication & Repair**

- Chromosomal organization
- Unit of replication
- Enzymes involved in replication
- Replication origin & replication fork
- DNA damage & repair mechanism

- **RNA Synthesis & Processing**

- transcription factors and machinery,
- formation of initiation complex,
- transcription activator and repressor,

- RNA polymerases,
- Capping elongation and termination,
- RNA processing (RNA editing, splicing, and polyadenylation)

➢ **Protein Synthesis & Processing**

- formation of initiation complex, initiation factors
- elongation and elongation factors,
- termination,
- aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase
- Post- translational modification of proteins).

UNIT – II: Biotechnology:

- Basics of genetic engineering, molecular tools of genetic engineering, host cells
- DNA isolation and purification
- Cloning vectors (phage, cosmid, BAC, YAC)
- Gene cloning, recombinant DNA technique, gene therapy
- Human genome project and future perspective

UNIT – III: Molecular Genetics:

- Isolation of specific nucleic acid sequence (PCR)
- Generation of genomic and c-DNA libraries
- In vitro mutagenesis
- Gene knock out in bacteria and eukaryotic organism
- DNA sequencing methods
- Micro array based technique
- Protein sequencing method

UNIT – IV: Research Papers:

- 3 – 5 Research Papers from each research fellow on topic of their Research.

BCH 604 (Paper – IV): "SEMINAR, FIELD WORK and REVIEW WRITING" (100 Marks)

SEMINAR: Seminar to be delivered on a relevant theme
FIELD WORK: Visit to industry/National institute and interaction with experts (Report to be submitted)
REVIEW: Preparation and submission of review article based on research papers addressing a contemporary research problem.
OTHER ACTIVITIES: Attending National/International workshop / Symposium / Conferences or participation for oral / poster presentation or interaction with M.Sc students for problem solving approaches / Work of Nobel laureates in last ten years in Science.

BCH 605 (Paper – V): DISSERTATION: (Guidelines) (200 Marks = 140+60 Marks)

I. Maximum Marks: 200(External Referee 140 marks and 60 marks for viva voce)
II. Each student has to carry out dissertation work under the supervision of a faculty of the concerned department. The dissertation has to be carried out in the department
III. Each student has to submit a dissertation on the topic of their study comprising of: (1) An introduction on the topic along with literature survey and justification for the selection of the topic. (2) Aim and objectives, (3) Materials and Methods/Methodology, (4) Observation / Results and Discussion and finally (5) Summary and Conclusion, along with the References.
IV. Each student has to give a midterm presentation of their work at the department.
V. Dissertation would be examined by Supervising Teacher and External Examiner.

❖ ***SUGGESTED READINGS:***

All important Scientific and Research Journals are to be referred for latest development in the subject and field of Biochemistry and Molecular Biology along with following books.

SN	Book	Author	Publisher	Year
1.	A manual of Laboratory Experiences in cell Biology	C. Edward Gasque	Univ. Book Stall, N. Delhi	1990
2.	An Introduction to Genetic Analysis	Griffiths et al.	W. H. Freeman & Co., NY	2004
3.	Animal Cell Culture Methods (Methods in Cell Biology, Vol.57)	J.P. Mather and D. Barnes	Academic Press, NY	Latest
4.	Animal Cell Culture, Practical Approach,	J. R. E. Masters,	Oxford Uni. Press, Oxford	Latest
5.	Applied Molecular Genetics.	Miesfield	Wiley & Sons Publication	1999
6.	Applied Statistics	Mukhopadhyay	Books and Allied (P.) Ltd.	2000
7.	Basic Genetics	R. F. Weaver & P. W. Hedrick	Wm C. Brown Pub, Oxford	1995
8.	Biochemistry	J. M. Berg, J. L. Tymoczko & L. Stryer	W.H.Freewan & Co., NY	2004
9.	Biochemistry and Mol. Biology	W.H. Elliott & D.C. Elliott	Oxford Press, Oxford	2005
10.	Bioinformatics	Higgins & Taylor		2000
11.	Bioinformatics – A Primer,	P. Narayanan	New Age Internat. Pub.	2005
12.	Bioinformatics. Methods and Protocols.	Misner & Krawetz	Humana Press, NJ	2000
13.	Biostatistics	A.E. Lewis		Latest
14.	Biotechnology	U. Satyanarayana	New Central Book, India	2006
15.	Cell and Molecular Biology	De Robertis, E.D.P. and De Robertis E M F		
16.	Cell and Molecular Biology	Garald Karp	J. Wiley & Sons, NY	2008
17.	Cell Biology, Genetics, Molecular Biology, Evolution and Ecology	P.S. Verma, V.K. Agarwal	S. Chand Pub., N Delhi	2004
18.	Cell Growth and Division, A Practical Approach.	R. Basega,	IRL Press, Oxford Univ.	Latest
19.	Chromosomes	Archana Sharma	Oxford & IBH Pub. N Delhi	1995
20.	Confocal Laser Scanning Microscopy	C.J.R. Sheppard & D. M. Shotton	BIOS Scientific Pub., UK	1997
21.	Culture of Animal Cells	R.I. Freshney,	A. R. Liss Inc., NY	1987
22.	DNA Science	Micklos & Freyer	Cold Spring Harbor Lab. Press, NY	1990
23.	Electron Microscopy in Molecular Biology	J. Sommerville & U. Scheer	IRL Press, Washington DC	1987
24.	Elementary Microbiology, Vol. 1 & 2	H. A. Modi	Akta Prakasan, Nadiad	1996
25.	Elements of Biotechnology	P.K. Gupta,	Rastogi R. Co., Meerut	1994
26.	Enzymes –Biochem, Biotech, Clin. Chem.	Trevor Palmer	A East West Press, N. Delhi	2004
27.	Essentials of Immunology ,	I. M. Roitt,	ELBS, Oxford Univ. Press	1998
28.	Fermentation Technology Vol. I & II	H. A. Modi	Pointer Pub, Jaipur	2008
29.	Flow Cytometry	M.G. Ormerod	Oxford Univ. Press, Oxford	1994

30.	Fundamental of Biochemistry	D. Voet, J. G. Voet & C. W. Pratt	John Wiley & Sons , Asia	2006
31.	Fundamentals of Biostatics – Practical Approach	Dutta	Kanishka Publ., N Delhi	2002
32.	Fundamentals of Statistics	S. Gupta	Himalaya Pub. House,	2005
33.	Gene Cloning – An Introduction	Brown	Stanley Thornes	1995
34.	Genes VIII	B. Lewin	Oxford Univ. Press, UK	2004
35.	Genetic Engineering	S. Rastogi & N. Pathak	Oxford Uni. Press, ND	2009
36.	Genetics and origin of species	Dobzhansky		
37.	Harper`s Biochemistry	R.K. Murray, D.K. Granner, A. A. Mayes. And V. W. Rodwell	MacGraw Hill, Asia	2003
38.	How the internet works	Priston Grall & Techmich		Latest
39.	HPLC Of Macromolecules	R.W.A. Oliver	IRL Press, Oxford Univ. Press, NY	1989
40.	Human Chromosomes. Manual of Basic Techniques	Verma & Babu	Pergamon Press. USA	1989
41.	Hybridoma technology in the Biosciences and Medicine	T. A. Sringer	Plenum Press, NY	Latest
42.	Immunology	Ivan M. Roitt, Jonathan Brostoff and David K. Male	Glower Medical Pub. Mosley / London	2000
43.	Immunology (Kuby)	R.A. Goldsby, T. J. Kindt, B. A. Osborne, J. Kuby	W. H. Freeman & Co. NY	2002
44.	Immunology and Immunotechnology	A.K.Chakravarty		Latest
45.	Introduction to Practical Molecular Biology	P.D. Dabre,	John Willey & Sons, NY	1988
46.	Light Microscopy in Biology	A. J. Lacey	IRL Press, Oxford Univ. Press, New York,	1989
47.	Manipulation & Expression of Recombinant DNA	Robertson et al.	Academic Press, NY	1997
48.	Modern Genetic Analysis,	Griffiths, Gilbert, Miller, Lewontin,	W.H. Freeman & CO, NY	1999
49.	Molecular Bio methods Hand book	Rapley & Walker		Latest
50.	Molecular Biology LabFax	T.A. Brown	Bios Sci. Publ., Oxford	1991
51.	Molecular Biology of the Cell	B. Albert, A. Johnson, J. Levis, M. Raff, K. Roberts, & P. Walter.	Garland Science	2002
52.	Molecular Biotechnology	S. B. Primrose	Blackwell Sci. Pub., Oxford	1994
53.	Molecular Cell Biology	H. Lodish, D. Baltimore, A. Berk, S. L. Zipursky, P. Matsudara and J. Darnell,	Scientific American books, USA	1995
54.	Molecular Cloning : A Laboratory Manual	J. Sambrook, E. F. Fritsch, & T. Maniatis	ColdSpring Harbor Lab. Presss, NY	2000
55.	Monoclonal Antibodies : Principles and Practice	J. W. Golding	Academic Press, NY	Latest
56.	Plant Tissue Culture	Razdan M. K.		
57.	Principles & Techniques of Biochemistry and Molecular Biology	K. Wilson & J. Walker	Cambridge University Press, NY	2006

58.	Principles of Fermentation Technology	P. Stanbury, A. Whitaker & S. Hall	Butterworth Heinemann	1995
59.	Principles of Genetics	E. J. Gardner, M. J. Simmons & D. P. Snustad	John Wiley & Sons, NY	2001
60.	Principles of Genetics	Robert H. Tamarin	Tata McGraw Hill, N Delhi	2002
61.	Principles of Microbiology	R. M. Atlas		
62.	Protein Purification	Robert K. Scopes	Springer (India), N Delhi	2004
63.	Recent Advances in Bioinformatics	Khan & Kanum	Ukraaz Publications	2003
64.	Recombinant DNA	Watson et al.	W. H. Freeman & Co, NY	1992
65.	Recombinant DNA and Biotechnology	Krenzer & Massey	ASM Press, USA	2000
66.	Recombinant DNA Principles and Methodology	James J Greene & Venigalla B. Rao		Latest
67.	Research Methodology Methods and Techniques (2nd edition)	C.R.Kothari	New Age International Publishers	2010
68.	Statistics & Experimental Design	Geoffrey M. Clarke	Edward Arnold, UK	1994
69.	Techniques in Microscopy and Cell Biology	A. K. Sharma	Tata MacGraw Hill Pub. Co., N Delhi	1991
70.	Textbook of Biotechnology	H.K. Das		Latest
71.	The Biochemistry of Cell Signalling	E. J. M.Helmreich	Oxford Univ.Press, N Delhi	2005
72.	The Cell: A Molecular Approach	Cooper & Hausman	A.S.M. Press, USA	2006
73.	The Eukaryotic Chromosome	Bostoc & Sumner	Elsevier	1980

Current references will be added whenever necessary. For each topic the current references will be given as and when needed

*** Above topics shall be prepared in consultation with research guide.**