GUJARAT UNIVERSITY

Ahmedabad – 380009,

Gujarat, India.

SYLLABUS

(June 2010 on wards and
Modified Course structure as per
MPhil Rules, Regulations and Ordinance 2015-No. 8.5)

M. Phil.

In

LIFE SCIENCES

GUJARAT UNIVERSITY
DEPARTMENT OF LIFE SCIENCES,
University School of Sciences
Ahmedabad – 380009, Gujarat, India.

M. Phil. in Life Sciences

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 2010 on wards

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
LSC 601	Research Methodology	60	4	30	70	100
LSC 602	Recent Advances in Life Science	60	4	30	70	100
LSC 603 (Elective)	Biotechnology and Applied life science	60	4	30	70	100
LSC 604	Practical / Projects / Experiments / Field Work / Seminar / Review	60	4	100		100
LSC 605	Dissertation		8		140 + 60	200
	Total		**24**	**190**	**410**	**600**

M. Phil Syllabus

LSC 601 (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, Ultracentrifuge
- *Spectroscopy*: UV, IR, 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: Radioactive Labeling, Molecular Biology Techniques & Microscopy:

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

Unit – IV: Bioinformatics and Biostatistics:

- Biological database, Proteomics, Genomics, Applications of Bioinformatics
- Mean, Median and Mode; Standard Error & Standard deviation
- T-test, Chi-square test (x_2), Regression
- Sampling distribution, Variance and Co-variance, ANOVA
- Probability distributions (Binomial, Poisson & Normal)
- Difference between parametric & nonparametric statistics.

LSC 602 (Paper-II): Recent Advances In Life Science. (100=70+30 Marks)

Unit – I: Immunology And Immunotechnology:

- Genetic basis of Antibody diversity & antibody engineering , Clonal selection
- Primary & secondary immune modulation.
- Inflammation, Congenital & acquired immunodeficiencies, Autoimmunity,
- Immune Response: MHC, HLA Complex,
- Complement fixation pathway
- Cytokines, Toll like receptors.
- Types of Vaccines, Transplantation immunology,
- Monoclonal & Polyclonal antibody.

Unit – II: Cell Culture:

- Laboratory, equipments and 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 and characterization
- Mass cultivation, Cell bank, Applications of Stem cells
- Cell differentiation.

Plant Tissue Culture Includes

- General techniques
- Nutrient medium
- Callus and suspension Culture
- Cloning and Regeneration, Transgenic Plants
- Secondary metabolites

Unit – III: Toxicology

- Types of toxicity and toxic effects, Factors influencing toxicity.
- Toxicants and classification of toxicants, Teratogenesis, Pesticides, Food additives, contaminations; Air, water and soil pollutants
- Estimation of toxicity: LD50, LC50; Genotoxicity.

Unit – IV: Principles Of Ecology, Ecotoxicity:

- Dynamic of ecosystem, Food Flow and energy flow.
- Community interactions, biotic and abiotic interactions.
- Types, mechanism and changes involved in succession, concept of climax.
- Environmental pollution, Ozone depletion, Green house effect, Global warming, Acid rain.
- Conservation and management of Wild life.
- Ranging pattern through direct, indirect & remote observations & Remote sensing methods.

LSC 603 (Paper-III): (Elective) Biotechnology And Applied Life Sciences: (100=70+30 Marks)

Unit – I: Cell Communication And Cell Signalling:

- Cell junctions, Cell – Cell interaction and Communications,
- G-Protein coupled receptors and its Regulation, Secondary messengers,
- Mechanism of Signal Transduction
- Reactive Oxygen Species (ROS), Antioxidants & its mechanism,
- Drug trial & Basics of clinical Research

Unit – II: Biotechnology:

- Basics of genetic engineering- molecular tools of genetic engineering, Host cells,
- DNA isolation and purification
- Cloning Vectors and gene cloning, Recombinant DNA technology Gene therapy
- Human Genome project & future perspective.

Unit – III: Microbial Technology:

- Microbial fermentations: Organic acid (citric acid), Amino acid (glutamic acid)
- Types of fermenters
- Bio-fertilizers, Microbial production of biogas
- Bioremediation, biotransformation & biodegradation.
- GMO's and their impacts

Unit – IV: Research Papers:

- *3 to 5 Research Papers from Each Research Fellow on topic of their Research*

LSC 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.

LSC 605 (Paper-V): DISSERTATION **(200 Marks = 140+60 Viva Voce)**

Dissertation – Guidelines

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. The topics of the dissertation can be selected from any branches of Life Sciences.
IV. 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*.
V. Each student has to give a midterm presentation of their work at the department.
VI. Dissertation would be examined by the 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 Life Sciences and Biotechnology 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.	Animal Cell Culture Methods (Methods in Cell Biology, Vol.57)	J.P. Mather and D. Barnes	Academic Press, NY	Latest
3.	Animal Cell Culture, Practical Approach,	J. R. E. Masters,	Oxford Uni. Press, Oxford	Latest
4.	Applied Statistics	Mukhopadhyay	Books and Allied (P.) Ltd.	2000
5.	Basic Genetics	R. F. Weaver & P. W. Hedrick	Wm C. Brown Pub, Oxford	1995
6.	Biochemistry	J. M. Berg, J. L. Tymoczko & L. Stryer	W.H.Freewan & Co., NY	2004
7.	Biochemistry and Mol. Biology	W.H. Elliott & D.C. Elliott	Oxford Press, Oxford	2005
8.	Bioinformatics	Higgins & Taylor		2000
9.	Bioinformatics – A Primer,	P. Narayanan	New Age Internat. Pub.	2005
10	Bioinformatics. Methods and Protocols.	Misner & Krawetz	Humana Press, NJ	2000
11	Biostatistics	A.E. Lewis		Latest
12	Biotechnology	U. Satyanarayana	New Central Book, India	2006
13	Cell and Molecular Biology	Garald Karp	J. Wiley & Sons, NY	2008
14	Cell Biology – Structure and Function	David E. Sadawa,	Jones and Barttett Pub., IND.	1993
15	Cell Biology LabFax	G.B.Dealtry & D. Rickwood	Bios Scientific Pub.	1992
16	Cell Growth and Division, A Practical Approach.	R. Basega,	IRL Press, Oxford Univ.	Latest
17	Chemistry for Life Sciences	Sutto R., Rockett B. & Swindells P	Taylor & Francis, London	2000
18	Chromosomes	Archana Sharma	Oxford & IBH Pub. N Delhi	1995
19	Concept of Ecology	Kormondy E. J.		
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	Ecology	Krebs C. J		
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	Essential Endocrinology	J. F. Laylook & P. H. Wise	ELBS, Oxford Univ. Press	1983
28	Essentials of Immunology ,	I. M. Roitt,	ELBS, Oxford Univ. Press	1998
29	Fermentation Technology Vol. I & II	H. A. Modi	Pointer Pub, Jaipur	2008
30	Flow Cytometry	M.G. Ormerod	Oxford Univ. Press, Oxford	1994

31	Fundamental of Biochemistry	D. Voet, J. G. Voet & C. W. Pratt	John Wiley & Sons , Asia	2006
32	Fundamentals of Analytical Chemistry	D. A. Skoog, D. M. West, F.J. Holler, & S. R. Crouch	Thomson Brooks / Cole, USA	2005
33	Fundamentals of Biostatics – Practical Approach	Dutta	Kanishka Publ., N Delhi	2002
34	Fundamentals of Ecology	Odum E.P.	W. B. Saunders Co. Lt	Latest
35	Fundamentals of Statistics	S. Gupta	Himalaya Pub. House,	2005
36	Gene Cloning – An Introduction	Brown	Stanley Thornes	1995
37	Genes VIII	B. Lewin	Oxford Univ. Press, UK	2004
38	Genetics and origin of species	Dobzhansky		
39	Harper`s Biochemistry	R.K. Murray, D.K. Garner, A. A. Mayes. And V. W. Rodwell	MacGraw Hill, Asia	2003
40	How the internet works	Priston Grall & Techmich		Latest
41	HPLC Of Macromolecules	R.W.A. Oliver	IRL Press, Oxford Univ. Press, NY	1989
42	Human Chromosomes. Manual of Basic Techniques	Verma & Babu	Pergamon Press. USA	1989
43	Human Cytogenetics – A practical approach (Vol. I & II)	Rooney & Czepulkowski	IRL Press at Oxford University Press, NY	1992
44	Hybridoma technology in the Biosciences and Medicine	T. A. Sringer	Plenum Press, NY	Latest
45	Immunology	Ivan M. Roitt, Jonathan Brostoff and David K. Male	Glower Medical Pub. Mosley / London	2000
46	Immunology (Kuby)	R.A. Goldsby, T. J. Kindt, B. A. Osborne, J. Kuby	W. H. Freeman & Co. NY	2002
47	Immunology and Immunotechnology	A.K.Chakravarty		Latest
48	Introduction to Practical Molecular Biology	P.D. Dabre,	John Willey & Sons, NY	1988
49	Light Microscopy in Biology	A. J. Lacey	IRL Press, Oxford Univ. Press, New York,	1989
50	Manipulation & Expression of Recombinant DNA	Robertson et al.	Academic Press, NY	1997
51	Modern Genetic Analysis,	Griffiths, Gilbert, Miller, Lewontin,	W.H. Freeman & CO, NY	1999
52	Modern Toxicology, Vol. 1-3	P. K. Gupta & D. K. Salunkhe	Metropolitan	1985
53	Molecular Bio methods Hand book	Rapley & Walker		Latest
54	Molecular Biology LabFax	T.A. Brown	Bios Sci. Publ., Oxford	1991
55	Molecular Biology of the Cell	B. Albert, A. Johnson, J. Levis, M. Raff, K. Roberts, & P. Walter.	Garland Science	2002
56	Molecular Biotechnology	S. B. Primrose	Blackwell Sci. Pub., Oxford	1994
57	Molecular Cell Biology	H. Lodish, D. Baltimore, A. Berk, S. L. Zipursky, P. Matsudara and J. Darnell,	Scientific American books, USA	1995
58	Molecular Cloning : A Laboratory Manual	J. Sambrook, E. F. Fritsch, & T. Maniatis	ColdSpring Harbor Lab. Presss, NY	2000

59	Monoclonal Antibodies : Principles and Practice	J. W. Golding	Academic Press, NY	Latest
60	Plant Breeding	B.D. Singh		
61	Plant Tissue Culture	Razdan M. K.		
62	Prenatal Diagnosis :The Human Side	Lenore Abramsky & Jean Chapple	Chapman & Hall, UK	1994
63	Principles & Techniques of Biochemistry and Molecular Biology	K. Wilson & J. Walker	Cambridge University Press, NY	2006
64	Principles and Methods of Toxicology	Hayes	Taylor and Francis	2000
65	Principles of Cell Biology	L. J. Kleinsmith & V.M.Kish	Harper & Row Pub. NY	1988
66	Principles of Fermentation Technology	P. Stanbury, A. Whitaker & S. Hall	Butterworth Heinemann	1995
67	Principles of Genetics	E. J. Gardner, M. J. Simmons & D. P. Snustad	John Wiley & Sons, NY	2001
68	Principles of Genetics	Robert H. Tamarin	Tata McGraw Hill, N Delhi	2002
69	Principles of Microbiology	R. M. Atlas		
70	Protein Purification	Robert K. Scopes	Springer (India), N Delhi	2004
71	Recent Advances in Bioinformatics	Khan & Kanum	Ukraaz Publications	2003
72	Recombinant DNA	Watson et al.	W. H. Freeman & Co, NY	1992
73	Recombinant DNA and Biotechnology	Krenzer & Massey	ASM Press, USA	2000
74	Recombinant DNA Principles and Methodology	James J Greene & Venigalla B. Rao		Latest
75	Research Methodology Methods and Techniques (2nd edition)	C.R.Kothari	New Age International Publishers	2010
76	Statistics & Experimental Design	Geoffrey M. Clarke	Edward Arnold, UK	1994
77	Techniques in Microscopy and Cell Biology	A. K. Sharma	Tata MacGraw Hill Pub. Co., N Delhi	1991
78	Textbook of Biotechnology	H.K. Das		Latest
79	The Biochemistry of Cell Signaling	E. J. M. Helmreich	Oxford Univ.Press, N Delhi	2005
80	The Cell: A Molecular Approach	Cooper & Hausman	A.S.M. Press, USA	2006
81	The Eukaryotic Chromosome	Bostoc & Sumner	Elsevier	1980
82	Toxicology	Niesink et. Al.	CRC Press	1995

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.***