

**University of Hyderabad**  
**School of Medical Sciences**  
**PhD Course work 2016-2017**

**Course Summary**

Courses	No. of credits	Responsible School
<b>I. Theory</b>		
1. Research methodology	4	SMS/SLS
2. Research ethics & management	2	SMS
3. Biostatistics	2	SMS
<b>II. Lab work (to be done in guides lab)</b>	4	SMS
Total	12	

**Detailed Syllabus**

**I. THEORY**

**1. Research Methodology (RM) (4 credits; 100 marks; 7 modules)**

Sl. No.	Topics	Sub-Topics	Hr.	Faculty
<b>I. Nucleic acid technology and Genomics</b>				
1.	Genomic Library and High throughput Genome Sequencing	1. High Insert Vectors such as BAC, PAC, YAC 2. Genomic Library Preparation 3. Preparation of Probe & Library Screening, 4. Identification of Clones and Physical Mapping 5. Fingerprinting of Clones 6. Preparation of Minimum Tilling Path 7. Sequencing of sub-clones by Sanger's method	3	
2.	Sequence assembly and Annotation of Genome	1. Assembly of small sequences by using software 2. Gene Prediction by Homology Search 3. <i>ab initio</i> Gene Prediction 4. Algorithms and software tools for gene identification such as GeneMark, GenScan etc.	1	
3.	Transcriptomics & Microarray	Transcriptomics & Microarray PCR, q-PCR, Pathway analysis	4	
4.	Reverse Genetics	1. Random deletion, Insertion, Point Mutation, Gene Silencing 2. Chemical Mutagenesis 3. TILLING	2	
5.	Genetic Engineering	Insertion mutagenesis, activation tagging, promoter tagging and characterization, Gene Knock Out/Knock In/Knock Down, Animal models: Transgenic and Xenograft	4	
<b>II. Proteomics</b>				
6.	Protein purification & separation techniques	Salting out, chromatography (ion exchange, gel filtration, affinity, HPLC); electrophoretic separation (SDS-PAGE, 2D-PAGE); detection systems (immunoblotting techniques, 2D DIGE etc.	3	MK

7.	Characterization of proteins by mass spectrometry	Fundamentals, Sample preparation, Ionization Techniques, Mass analyzers, Peptide fragmentation mechanism, Interpretation of Mass Spectra - basics, spectra, sequence data, databases, tools and resources, use of Bruker software.	2	
8.	Bioinformatic analysis of protein structures	Protein data bank and structures	2	
9.	Crystallization of proteins	Theoretical aspects and X-ray crystallography	3	
<b>III. Biophysical techniques</b>				
10.		Absorption Spectroscopy, Fluorescence Spectroscopy and Circular Dichroism	3	
11.		NMR, and Light scattering methods	3	
12.		Mass Spectra and Calorimetry	2	
<b>IV. Microbiological techniques</b>				
13.		Microbiological quality check, maintenance and preservation of microorganisms	1	AHS
14.		Measurement of antimicrobial activity	1	AHS
<b>V. Immunological techniques</b>				
15.		Production of antibody (monoclonal and polyclonal)	1	AHS
16.		Use of antibody in basic and clinical research	1	
17.		Multiplex ELISA, IF, ICC, IHC	1	
18.		Flow cytometry	1	
19.		Western blotting techniques	1	
<b>VI. Cell culture techniques</b>				
20.	Animal/human	Animal /Human cell culture techniques	4	GKV
<b>VII. Microscopic techniques</b>				
22.	Light microscopy	Fundamental basis of all major aspects of light microscopy including transmitted light, phase contrast, differential interference, instrumentation, applications including some sample preparation methods	1	GKV
23.	Fluorescence microscopy	Instrumentation, principles of fluorescence imaging, applications including live cell imaging, confocal microscopy, FRET, FRAP etc. (includes some practical training)	1	
24.	Electron microscopy	Principle, types of electron microscopy, applications and sample preparation methods (Demo of TEM)	2	
Total			47	

**2. Research ethics and management (2 credits; 50 marks)-**

- a) Principles of Bioethics – Dr MK
- b) Regulatory framework in India and University- Dr GKV

**3. Biostatistics (2 credits; 50 marks)**

- a. **CONCEPTS OF CONFIDENCE INTERVALS**
  - Confidence Interval of a Proportion
  - The Standard Deviation (mean, median, mode)
  - The Gaussian Distribution
  - Poisson distribution
  - The Confidence Interval of a Mean
  - Survival Curves
- b. **COMPARING GROUPS WITH CONFIDENCE INTERVALS**
  - Confidence Interval of a Difference between Means
  - Confidence Interval for the Difference or Ratio of Two Proportions: Prospective Studies
  - Confidence Interval of The Ratio of Two Proportions: Case-control Studies
- c. **INTRODUCTION TO P VALUES**
  - What is a P value?
  - Statistical significance and hypothesis testing
  - Interpreting significant and not significant P values
  - Multiple comparisons
- d. **BAYESIAN LOGIC**
  - Interpreting lab tests: Introduction to Bayesian thinking
  - Bayes and statistical significance
  - Bayes' theorem in genetics
- e. **CORRELATION AND REGRESSION**
  - Correlation
  - An introduction to regression
  - Simple linear regression
- f. **DESIGNING CLINICAL STUDIES**
  - The design of clinical trials
  - Clinical trials where N=1
  - Choosing an appropriate sample size.
  - Survival Studies

**II. Lab work (4 credits; 100 marks)**

Lab work has been divided into following topics:

- 1. Scientific Writing and Seminars - 1 credit 25 Marks
  - Writing scientific proposals and generating hypothesis
  - Interpreting scientific data and research article presentation
- 2. Experiment planning and analysis - 1 credit 25 Marks
  - Designing an experiment
  - Trouble shooting a given problem

- Analysis of scientific data

3. Laboratory work

- 2 credits

50 Marks

- Execution of experiments depends on supervisor's interest.