BHARATHIAR UNIVERSITY: COIMBATORE-641 046
CENTER FOR COLLABORATION OF INDUSTRY AND INSTITUTIONS(CCII)

POST GRADUATE DIPLOMA IN MOLECULAR MEDICINE
(For the CCII students admitted from the academic year 2014-15 and onwards)

Duration: One year (Two Semesters)

SCHEME OF EXAMINATIONS

Paper	Course Title	**Dur. Hrs.**	**Total Marks**
	SEMESTER –I		
I	Principles of Molecular Biology	3	100
II	Research methodology including Bioethics	3	100
III	Bioinformatics and BioSafety	3	100
IV	Practical's-I- Basic Molecular Biology Techniques-I	3	100
	SEMESTER –II		
V	Molecular Medical Microbiology	3	100
VI	Fundamentals of Immunology	3	100
VII	Human Genetics	3	100
VIII	Practical's-II- Basic Molecular Biology Techniques-II Project work	3	100
	TOTAL		800

SEMESTER-I
PAPER I- Principles of Molecular Biology

Aim: At the end of the session, the student would able to impart basis knowledge and principles of molecular biology.

Unit I
Biomolecules – Carbohydrates, protein, lipids, vitamins- Types, Structure and Function.

Unit 2
Nucleic acid structure and gene organization in Prokaryotes and Eukaryotes. Cell membrane-membrane channels and pumps

Unit 3
DNA replication and DNA transcription- Decoding of mRNA and Protein synthesis, protein modification and transport- DNA repair and Recombination

Unit 4
Gene regulation: Prokaryotic gene regulation- Operon concept, Eukaryotic gene regulation, Transcriptional and Translational regulations

Unit 5
Recombinant DNA: Vectors in gene cloning- Plasmids, bacteriophages, cosmids, BAC and YAC, library construction and screening, expression strategies in prokaryotes.

Reference Material:

1. Primrose. S.B., Twyman R.M., Old. R.W. (2001) Pricinciples of Gene Manipulation. Blackwell Science Limited.
2. Bernard R. Glick, Jack J. Pasternak, Asm Press.
3. Molecular Cell Biology, 4th edition Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. New York: W. H. Freeman; 2000. ISBN-10: 0-7167-3136-3
4. Molecular Biology of the Cell. 4th edition. Alberts B, Johnson A, Lewis J, et al. New York: Garland Science; 2002
5. Human Molecular Genetics, 2nd edition, Tom Strachan and Andrew P Read. New York: Wiley-Liss; 1999. ISBN-10: 1-85996-202-5
6. An Introduction to Genetic Analysis. 7th edition. Griffiths AJF, Miller JH, Suzuki DT, et al. New York: W. H. Freeman; 2000.
7. Modern Genetic Analysis, Anthony JF Griffiths, William M Gelbart, Jeffrey H Miller, and Richard C Lewontin. New York: W. H. Freeman; 1999. ISBN-10: 0-7167-3118-5
8. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox. W. H. Freeman, Hardback, Fifth edition, 2008. 4to. xxix, 1158 pp., G-17, C-8, A-4, AS-35, I-41.

PAPER II- Research methodology including Bioethics

Aim: To given an outlook about research, research concepts and designs. To given an introduction about bioethics and basic knowledge about applying various statistical methods in research

Unit I
Introduction: Definition and objectives of Research – Types of research, Various Steps in Research process, Purpose, Design, Survey and Case study research.

Unit 2
Quantitative Methods for problem solving: Statistical Modeling and Analysis, Time Series, Mean, Meadian, Mode, Standard Deviation, T-test, ANOVA, Correlation and Regression,

Unit 3
Priciples of Bioethics, Informed consent, Confidentiality and Conflict of Interest

Unit 4
IPR and patenting, The Ethical, Legal and Social Implications (ELSI), World Intellectual Property Rights Organization (WIPO)

Unit 5
Writing a research protocol, Reporting and thesis writing, Structure of the thesis, Scientific presentations

Reference Materials

1. Nigel M, Cameroon DS. Life and Death after Hippocrates: The New Medicine. Wheaton IL, Ed. Crossway Books, 1991: 23-45.
2. Veatch RM. A Theory of Medical Ethics. New York, Basic Books, 1991: 125-6.
3. Cassel CK. The patient-physician convenant: An affirmation of Asklepios. Ann Intern Med 1996; 124: 604-6.
4. Steinbrook R. Controlling conflict of interest-proposals from the institute of medicine. New Engl J Med 2009; 360: 2160-3.
5. Jagsi R, Tarbell NJ, Weinstein DS. Becoming a doctor, starting a family- Leaves of absence from graduate medical education. New Engl J Med 2007, 357: 1889-91.
6. Allen J. Love and conflict: A Convenantal Model of Christian ethics. Nashville, TN: Abdingdon Press, 1984.
7. Rusthoven JJ. Understanding Medical relationships through a convenantal ethical perspective. Perspective Science Christian Faith; 62:3-15.
8. Beauchamp TL, Childress JF. Principles of Biomedical Ethics, 6th Edn. Oxford, Oxford University Press, 2001: 397-408.
9. Veatch R. Medical codes and oaths. In: Encyclopedia of Bioethics, 2nd Edn. New York, Simon & Schuster Macmillan, 1995: 1419-35.
10. Research Methodology: Methods and Techniques By C. R. Kothari second edition 2004 New age international Publishers
11. Designing Clinical Research :Stephen Hulley 4th Edition
12. Basic Epidemiology : WHO 2nd edition : R Bonita R Beaglehole, T Kjellstrom

In addition, a compendium of interesting articles will be provided to each candidate as part of reading material.

PAPER III- Bioinformatics and Biosafety

Aim: To expose the students to study the basic knowledge about bioinformatics and biosafety

Unit I
Biological databases: Gen bank, protein databases, Pubmed, Entrez, OMIM, BLAST, EBI and EXPASY

Unit 2
Sequence Alignment- Global and Local Alignment, Microarray databases, RNA-seq data analysis, Image Analysis and Data analysis

Unit 3
Proteome analysis, Protein structure prediction, Homology modelling, Genome Annotation, Functional genomics and Drug design

Unit 4
Evolutionary Concepts in Genetics and Genomics, Phylogenetics analysis, Role of bioinformatics in taxonomy, miRNomics, MicroRNA and noncoding RNA –related data sources.

Unit 5
Principles of Biosafety, Risk assessment and Risk management, Safety Protocols, Facility Design and Construction, Laboratory Practice- Good Microbiological Practice (GMP), Decontamination, Waste and Decommissioning. Biosafety Guildelines and Regulations (National and International).

Reference Materials

1. Introduction to Bioinformatics By Anna Tramontano 2008 Chapman & Hall/CRC
2. Sequence - Evolution – Function Computational Approaches in Comparative Genomics, Eugene V Koonin and Michael Y Galperin. National Center for Biotechnology Information, National Library of Medicine, National Institutes of Health Boston: Kluwer Academic; 2003. ISBN-10: 1-40207-274-0
3. Exploring bioinformatics : a project-based approach St Clair, Caroline; Visick, Jonathan.Second edition. Burlington, Massachusetts : Jones & Bartlett Learning, [2015]
4. RNA-seq data analysis : a practical approach. Korpelainen, Eija; Tuimala, Jarno; Somervuo, Panu; Huss, Mikael; Wong, Garry. Boca Raton : Taylor & Francis, 2015. NLM ID: 101635331.
5. Computational chemogenomics. Jacoby, Edgar.Singapore : Pan Stanford Publishing, [2014]
6. Introduction to bioinformatics. Lesk, Arthur M. Fourth edition. Oxford : Oxford University Press, [2014]
7. miRNomics : microRNA biology and computational analysis. Yousef, Malik; Allmer, Jens. New York : Humana Press, [2014].
8. Guidelines for laboratory design : health, safety, and environmental considerations DiBerardinis, Louis J, 1947-; Baum, Janet S; First, Melvin W; Gatwood, Gari; Seth, Anand K, 1945-.Fourth edition. Hoboken, New Jersey : Wiley, [2013]
9. Biological safety : principles and practices. Fleming, Diane O; Hunt, Debra Long. 3rd ed. Washington, D.C. : ASM Press, c2000.

PAPER IV -Practicals I – Basic Molecular Biology Techniques-I

Aim

To impart general ideas about basic techniques applied in molecular biology experiments.

Name of the Experiments

1. Isolation of Nucleic acids and electrophoresis
2. Preparation of competent cells
3. Plasmid isolation and transformation
4. PCR and Molecular cloning
5. Restriction digestion and fragment length polymorphisms
6. Recombinant protein expression
7. cDNA synthesis and Reverse Transcriptase PCR

Reference Materials

1. DNA cloning and assembly methods. Valla, Svein; Lale, Rahmi; Springer Science+Business Media. New York : Humana Press, [2014]
2. Recombinant gene expression : reviews and protocols. Lorence, Argelia. 3rd ed. New York : Humana Press, c2012.
3. Essential Molecular Biology Vol 2 Second Edition Edited by Terry Brown. Practical Approach Series 255

SEMESTER- II
PAPER V: Molecular Medical Microbiology

Aim: At the end of the session, the student would able to acquire basic knowledge about microbes and its molecular pathogenesis.

Unit I
Introduction to pathogens: Bacteria, Viruses and Fungi. Normal flora. Bacterial genetics, Bacterial Metabolism

Unit 2
Molecular basics of pathogensis- Malaria, Leptospira, Treponema

Unit 3
Molecular basis of pathogenesis- Staphylococcus, Sterptococcus, Micrococcus, Enterococcus, Neisseria Helicobacter pylori, Tuberculosis

Unit 4
Molecular basis of pathogenesis- HIV, Dengue, Swine flu, Influenza, Measles, Mumps and Hepatitis

Unit 5
Molecular basis of pathogenesis- Aspergillosis, candidiasis, Superficial, Subcutaneous and Systemic mycosis.

Reference Material:
1. Medical Microbiology. 4th edition. Baron S, editor. Galveston (TX): University of Texas Medical Branch at Galveston; 1996.
2. Molecular Medical Microbiology, Three-Volume Set, 2nd Edition, Editor(s) : Tang & Sussman & Liu & Poxton & Schwartzman. Academic Press. 2014.
3. Medical mycology : cellular and molecular techniques. Kavanagh, Kevin. Chichester, West Sussex, England ; Hoboken, NJ : John Wiley & Sons, c2007.
4. Molecular medical microbiology. Sussman, Max. San Diego : Academic Press, c2002.

PAPER VI: Fundamentals of Immunology

Aim
Completion of this paper will pave the way for the student to determine fundamental concepts about immunology.

Unit 1
Principles of Innate and adaptive immunity-Fundamentals- Cells involved in Immune response

Unit 2
Immunoglobulin's -Structure and Function- Antibodies and antigens Complement- Cytokines and signalling.

Unit 3
Biology of the B lymphocyte -- How T cells recognize antigen - the role of the major histocompatibility complex Immunological responses: Humeral & cell mediated responses.

Unit 4
Biology of the T lymphocyte -- Activation and function of T cells, Regulatory T cells -- Helper T-cell subsets and control of the inflammatory response -- Cytotoxic T lymphocytes.

Unit 5
Immunologic tolerance- autoimmunity- Tumor immunology -Transplantation immunology.

Reference Materials

1. Cellular and molecular immunology. Abbas, Abul K; Lichtman, Andrew H; Pillai, Shiv. Eighth edition. Philadelphia, PA : Elsevier Saunders, [2015]
2. Immunology : a short course Coico, Richard; Sunshine, Geoffrey. Seventh edition. Chichester, West Sussex, UK ; Hoboken, NJ : John Wiley & Sons Inc., 2015.
3. Clinical immunology : principles and practice. Rich, Robert R. 4th ed. [St. Louis, Mo.] : Elsevier/Saunders, c2013.
4. Fundamental immunology. Paul, William E.7th ed. Philadelphia : Wolters Kluwer Health/Lippincott Williams & Wilkins, c2013.

PAPER VII: HUMAN GENETICS

Aim:

At the end of the session, the student would able to acquire knowledge about fundamentals of human molecular genetics.

Unit I

Principles of Human genetics: Introduction to human genetics;cytogenetics- chromosomal basis of inheritance; molecular genetics- The genetic basis of inheritance; modes of interitance; genetic basis of variation: polymorphism and Mutation.

Unit II

Applications of Human genetics: immunogenetics; developmental genetics; cancer genetics; genetic basis of cardiovascular disease; genetic basis of hematologic disorders; genetics of ageing.

Unit III

Pharmacogentics: pharmacogenetics of cytochromo P450; Pharmacogenetics- Abacavir, Carbamazepine, 5-fluroruracil, Irinotecan, 6-mercaptopurine & Warfarin; Pharmacogenomics in onocology; psychiatry and addiction medicine; Pharmacogenomics in neurology; Pharmacogenomics of gastrointestinal drugs; focus on proton pump inhibitors.

Unit IV

Diagnosis of disease: patterns of inheritance; cytogenetics; molecular cytogenetics; molecular genetics; cancer genetics.

Unit V

Prevention of disease: prenatal diagnosis ; genetic counselling

Reference Materials

1. Human Genetics. A.Gardner, R.T.Howell and T.Davies Viva Books Private limited.Published by arrangement with Scion Publishing Limited, UK. First edition 2008.
2. Essentials of Human Genetics. Manu L Kothari, Lopa A Mehta, Sadhana S Roychoudhury.Universities press (India) private limited. Fifth edition, 2009.
3. Pharmacogenetics, kinetics, and dynamics for personalized medicine. Kisor, David F. Burlington, MA : Jones & Bartlett Learning, c2014.
4. Human genetics and genomics. Korf, Bruce R; Irons, Mira B. 4th ed. Chichester, West Sussex, UK : John Wiley & Sons, 2013.
5. Pharmacogenomics : an introduction and clinical perspective. Bertino, Joseph S. New York : McGraw-Hill, 2013.
6. Medical genetics. Schaefer, G Bradley; Thompson, James N.New York : McGraw-Hill Education, 2014.
7. Molecular pathology in clinical practice. Leonard, Debra G B. New York : Springer, c2007.
8. Molecular basis of health and disease. Das, Undurti N. Dordrecht ; New York : Springer, [2011].
9. The molecular and genetic basis of neurologic and psychiatric disease. Rosenberg, Roger N.4th ed. Philadelphia : Wolters Kluwer/Lippincott Williams & Wilkins, c2008.
10. Genomic disorders : the genomic basis of disease. Lupski, James R, 1957-; Stankiewicz, Paweł. Totowa, N.J. : Humana Press, c2006.

PAPER VIII-Practicals -II

Basic Molecular Biology Techniques-II

Project work for 6 months under a faculty

Structured Viva

Objective Structured Practical Examinations

Name of the experiments
1. Basic cell culture techniques
2. Isolation and culturing PBMC
3. Introduction to HPLC
4. Introduction to Flowcytometry demo
5. Real Time PCR

Reference Materials

1. Basic cell culture protocols. Helgason, Cheryl D; Miller, Cindy L. 4th ed. New York : London : Humana Press ; Springer [distributor], c2013.

2. Quantitative real-time PCR : methods and protocols. Biassoni, Roberto; Raso, Alessandro. New York : Humana Press, [2014]

3. Basic principles in flow cytometry. Kalodimou, Vasiliki E; AABB. Bethesda, Md : AABB Press, 2013.

4. Principles and practice of bioanalysis. Venn, Richard F, 1949-.2nd ed. Boca Raton : CRC Press, 2008