

U.G. 3rd SEMESTER SYLLABUS (BSc-Biotechnology)
DEPARTMENT OF MOLECULAR BIOLOGY AND BIOTECHNOLOGY
COTTON UNIVERSITY

PAPER : BTN301C

IMMUNOLOGY
(Credits: 3+1+1=5)

Theory

Unit 1: Concept of immune system -types of immunity: innate and adaptive, cell mediated and humoral immunity, primary and secondary immune response **3 hours**

Unit 2: Development of immune system: haematopoiesis, immunity in the newborn **3 hours**

Unit 3: Components of immunity: innate immunity: mechanical barriers, chemical barriers, phagocytosis, fever, inflammation, acute phase proteins; cells and organs of the immune system: lymphoid cells, mononuclear phagocytes, granulocytic cells; primary lymphoid organ, secondary lymphoid organ, mucosa-associated lymphoid tissues **7 hours**

Unit 4: Antigens: general properties, antigenicity and immunogenicity, epitopes, haptens, adjuvants **3 hours**

Unit 5: Immunoglobulins; structure, classification and functions, allotypes and idiotypes **3 hours**

Unit 6: Major Histocompatibility Complex: structures and function of class I, class II and class III MHCs; antigen processing and presentation-endogenous and exogenous pathway **5 hours**

Unit 7: Lymphocyte activation: receptors, co-receptors and signaling B cell activation, T cell activation, maturation of B and T lymphocytes; cell mediated immunity: T cytotoxic cells, T helper cells, NK cell cytotoxicity, antibody dependent cell mediated cytotoxicity **6hours**

Unit 8: Antigen- antibody Interaction: agglutination and precipitation, radial immuno assay, ELISA, immunoblotting **6 hours**

Unit 9: Cytokines: nomenclature, cytokine families, properties and function **4hours**

Unit10: Hypersensitivity and immunodeficiency: introduction to hypersensitivity, of hypersensitivity, introduction to primary and secondary immunodeficiency disorders **4hours**

Unit11: Vaccination: principles of vaccination, immunization, types of vaccines; vaccine- live attenuated, sub-unit, recombinant, anti-idiotypic, toxoid, DNA vaccines **4 hours**

Practical

1. Blood coagulation tests
2. Blood group determination
3. Immunodiffusion Assay

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4. Preparation of blood smears for pathological screening
5. Dot ELISA

Suggested Readings

1. Immunology- Kindt. T.J., Goldsby, R.A., Osborne, B.A. and Kuby, J., W. H. Freeman, 2007.
2. Essential Immunology- Roitt. I.V. and Delves, P.J., Blackwell Publishing Co., 2004.
3. Cellular and Molecular Immunology- Abbas. A.K., Lichtman. A.H. and Pillai, S. Elsevier. 2015.
4. Immunology: Introductory text book- Shetty, N., New Age International Publishers, India, 1998.
5. Immunology- Owen. J., Punt J. and Stranford. S. Kuby, W.H. Freeman, 2013.

PAPER : BTN302C

GENETIC ENGINEERING
(Credits: 3+1+1=5)

Theory

Unit 1: Introduction to genetic engineering, milestones of genetic engineering- historical perspective, recombinant DNA technology- definition, scope **5 hours**

Unit 2: Molecular tools and applications- restriction and modification enzymes. gene cloning; plasmids and other cloning vectors, expression vectors, host and their properties; principle and applications of Polymerase Chain Reaction (PCR), primer-design; RT-PCR (Reverse transcription PCR). **10 hours**

Unit 3: Strategies for gene transfer to plant cells, direct DNA transfer to plants; transfection of animals, gene construct- promoters and regulatory sequences, marker and reporter genes, detection of transgene. **10 hours**

Unit 4: Restriction and modification system, restriction mapping. southern, northern and western hybridization, preparation and comparison of genomic and cDNA library, screening of recombinants. **8 hours**

Unit 5: Random and site-directed mutagenesis: primer extension and PCR based methods of site directed mutagenesis, random mutagenesis, gene shuffling, production of chimeric proteins. **8 hours**

Unit 6: DNA sequencing techniques- introduction to Maxam-Gilbert's method and Sanger's dideoxy method of DNA sequencing, automated DNA sequencing, introduction to next generation sequencing. **7 hours**

Practical

1. Isolation and quantification of Plasmid DNA

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2. Restriction digestion of Plasmid DNA
3. Agarose gel electrophoresis
4. Demonstration of PCR

Suggested Readings

1. Gene Cloning and DNA Analysis- Brown TA. (2006). Blackwell Publishing, Oxford, U.K.
2. Biotechnology-Applying the Genetic Revolution- Clark DP and Pazdernik NJ. (2009). Elsevier Academic Press, USA
3. Molecular Biotechnology- Principles and Applications of recombinant DNA- Glick, B.R., Pasternak, J. J. (2003). ASM Press, Washington
4. Principles of Gene Manipulation and Genomics- Primrose SB and Twyman RM. (2006). Blackwell Publishing, Oxford, U.K.
5. Molecular Cloning-A Laboratory Manual- Sambrook J, Fritsch EF and Maniatis T. (2001). Cold Spring Harbor Laboratory Press.

PAPER : BTN303C

COMPUTER APPLICATION AND BIOINFORMATICS
(Credits: 3+1+1=5)

Theory

Unit 1: Fundamentals of Computer: Computer organization, Operating systems-DOS, Windows, Linux. **4 hours**

Unit 2: Computer- system, topology and peripherals for communication; Internet-basics, connection- LAN, WAN; web browsing and URL, search engines. **6 hours**

Unit 3: Introduction to Bioinformatics-definition, development of bioinformatics, various branches-genomics, transcriptomics, proteomics, system biology, metabolomics, molecular phylogeny. **10 hours**

Unit 4: Database-definition, biological databases-classification, protein and nucleic acid sequence database ; NCBI-tools and databases-Entrez, sequence submission, BLAST, ORF finder, PubMed, PubMed Central **10 hours**

Unit 5: File format- GeneBank Flat-file, FASTA, EMBL, Clustal, UniProt/SwissProt, Protein Data Bank (PDB) **8hours**

Unit 6: Gene and protein sequence analysis-local, global, pairwise & multiple alignments; phylogenetics- CLUSTAL, PHYLIP & UPGMA; protein prediction- physical properties, secondary structure- alpha & beta structure, motifs, tertiary structures, specialized structure and function; visualization of protein molecular conformation and visualization tool (RASmol). **10 hours**

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Practical

1. Familiarization with Windows, Linux.
2. MS Excel-graphical and statistical applications, MS PowerPoint-application
3. Various resources at NCBI
4. Biological databases- Search and information retrievals, sequence retrieval.
5. Tools in database search: sequence alignment, BLAST, RASmol.
6. Phylogenetic analysis.

Suggested Readings

1. Discovering Genomics, Proteomics, and Bioinformatics- Campbell and Heyer, Benjamin Cummings, 2002.
2. Developing Bioinformatics Computer Skill- Cynthia. G. and Per. J., O'Reilly Publication, 2001
3. Bioinformatics: A practical guide to the analysis of genes and proteins- Baxevanis. A.D. and Ovellette B. F. F. Wiley-Interscience, 2000.
4. Essential Bioinformatics- Jin Xiong, Cambridge University Press, 2006.

SEMESTER III
PAPER: BTN101SEC

BIOPROSPECTION OF INDIGENOUS RESOURCES
CREDITS: 1+0+1

Theory

Unit 1: Fermented food and its scope: indigenous fermented food of NE region- types, nutritional and medicinal values; value addition to fermented food. **8 hours**

Unit 2: Mushroom cultivation: edible and poisonous mushroom. nutritional value, cultivation technique **8hours**

Practical

1. Analysis of fermented food- sensory, microbial, biochemical
2. Laboratory scale production of fermented food
3. Mushroom cultivation.
4. Field/lab visit

Suggested Readings:

1. Food Microbiology- M. R. Adams, M. O. Moss; New Age Publication
2. Food Microbiology - William C Frazier, Dennis C Westoff, K N Vanitha
3. Mushroom Biotechnology: Developments and Applications- Marian Petre; Academic Press
