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VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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ક્રમાંક : એકે./પરિપત્ર/૧૦૩૫૮/૧૯
તા. ૨૦/૦૬/૨૦૧૯

પ્રતિ,
કો–ઓર્ડિનેટરશ્રી,
બાયોટેકનોલોજી ડિપાર્ટમેન્ટ,
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી,
સુરત.

વિષય :– One year P.G.Diploma Course In Molecular and Biochemical Technology નાં અભ્યાસક્રમ બાબત.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, One year P.G.Diploma Course In Molecular and Biochemical Technologyનાં રીવાઈઝ અભ્યાસક્રમ અંગે ચર્ચા કરતા Biotech વિષયની(નિયૂકત) એડહોક સમિતિની તા.૧૩/૦૨/૨૦૧૯ની સભાનાં ઠરાવ ક્રમાંકઃ ૩ અન્વયે કરેલ નીચેની ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૦૨/૦૫/૨૦૧૯ ની સભાનાં ઠરાવ ક્રમાંકઃ ૧૩ અન્વયે સ્વીકારી તે મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલએ તેની તા.૦૭/૦૬/૨૦૧૯ની સભાનાં ઠરાવ ક્રમાંકઃ ૫૧ અન્વયે સ્વીકારી મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્ઉપરાંત તેનો અમલ કરવો.

બી.એસસી. એન્ડ એમ.એસસી. બાયોટેક વિષયની નિયૂકત (એડહોક)સમિતિની તા.૧૩/૦૨/૨૦૧૯ની સભાનાં ભલામણ ક્રમાંકઃ ૩

:: આથી ઠરાવવામાં આવે છે કે, One year P.G.Diploma Course In Molecular and Biochemical Technology નો અભ્યાસક્રમ મંજૂર કરી તે મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

વિજ્ઞાન વિદ્યાશાખાની તા.૦૨/૦૫/૨૦૧૯ ની સભાનાં ઠરાવ ક્રમાંકઃ ૧૩

:: આથી ઠરાવવામાં આવે છે કે, One year P.G.Diploma Course In Molecular and Biochemical Technology નો અભ્યાસક્રમ સ્વીકારી તે મંજૂર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૭/૦૬/૨૦૧૯ ની સભાનાં ઠરાવ ક્રમાંકઃ ૫૧

:: આથી ઠરાવવામાં આવે છે કે, વિજ્ઞાન વિદ્યાશાખાએ તેની તા. ૦૨/૦૫/૨૦૧૯ ની સભાના ઠરાવ ક્રમાંક : ૧૩ અન્વયે ભલામણ કરેલ One year P.G.Diploma Course In Molecular and Biochemical Technology નો અભ્યાસક્રમ સ્વીકારી મંજૂર કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ઈ.ચા.કુલસચિવ

પ્રતિ,
૧) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા
૨) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
૩) પી.જી. વિભાગ, વી. ન. દ. ગુ. યુનિવર્સિટી, સુરત.

...તરફ જાણ તેમજ અમલ સારૂ.

Department of Biotechnology
Veer Narmad South Gujarat University

Diploma Course:

Title: One Year P.G. Diploma Course in Molecular & Biochemical Technology

Course overview/description:

This course aims to provide an interdisciplinary edge to young professionals to make a career in Molecular & Biochemical Technology. It has been found that graduates from non-life sciences background find it difficult to gain footing in such industries. This course will provide such individuals a basic understanding of Biophysical Technology, Recombinant DNA Technology and Immunology. This will give them advantage over traditional degree holders. The nature of this course is broad based and will give a good insight into modern biology and important component of hands-on training to the students.

Objectives:

- To develop an appreciation and understanding of core principles of Molecular biology & Biochemical Technology.
- To develop a scientific temperament and a problem solving approach using molecular methods.
- To gain a practical knowledge about working of Instruments, DNA extraction, Estimation of Biomolecules, Tissue culture, Immunological techniques etc.

No. of Seats: 20

Minimum Eligibility:

Graduates with minimum 50% aggregate in the disciplines of B. Sc. Life Sciences, B. Sc. Botany/ Biochemistry/ Microbiology/ Zoology/ Applied Zoology/ Applied Sciences/ Biomedical Sciences/ Biological Sciences/ Biotechnology, B. Tech. Biotech. and B. Pharm.

Time Period: 1 year

Course Fees: Rs. 30,000/-

Course Timings:

40 hours a week

No. of Credits: 40

1. Theory Hours: 360 h (24 credits)

2. Practical Hours: 180 h (12 credits)

3. Assignments, Presentations and Projects: 60 h (4 credits)

Total hours: 1 + 2 + 3 = 600 h (40 credits)

Course Structure

Module	Module Code	Module Name	Credits	Hours
Semester-I				
I	**PGD: MB-101**	Biophysical Techniques-I	4	60
II	**PGD: MB-102**	Recombinant DNA Technology-I	4	60
III	**PGD: MB-103**	Immunology-I	4	60
IV	**PGD: MBL-104**	Labwork-I	2	30
V	**PGD: MBL-105**	Labwork-II	2	30
VI	**PGD: MBL-106**	Labwork-III	2	30
VII	**PGD: MBL-107**	Seminar	1	15
Semester-II				
VIII	**PGD: MB-201**	Biophysical Techniques-II	4	60
IX	**PGD: MB-202**	Recombinant DNA Technology-II	4	60
X	**PGD: MB-203**	Immunology-II	4	60
XI	**PGD: MBL-204**	Labwork-IV	2	30
XII	**PGD: MBL-205**	Labwork-V	2	30
XIII	**PGD: MBL-206**	Labwork-VI	2	30
XIV	**PGD: MBP-101**	Project	3	45
		Total	40	600

Course content:

Module 1: Biophysical Techniques-1
Quantification of Proteins, Separation of Proteins, Purification of Proteins & Basic concept of Enzyme, Tissue Culture

Module II: Recombinant DNA Technology -1
Concept of gene manipulation, Cloning vectors, Linkage & DNA library, Screening Technique

Module III: Immunology–I
Overview of the Immune system, Antigen & Antibodies, Antigen antibody interactions, B Cell biology & Antibody diversity.

Module IV: Lab work-I
Analysis, Estimation, Purification and Electrophoresis of Biomolecules, Enzyme parameter optimization

Module V: Lab work–II
Isolation of *E coli* DNA, Plasmid DNA, Digestion and recovery of DNA

Module VI: Lab work–III
Assessment of Cell Viability, Isolation of splenocytes, Immunoelectrophoresis

Module VII: Seminar
Each student is required to deliver a seminar on any Molecular & Biochemical technology topic approved by the Coordinator / Head of the Department of Biotechnology

Module VIII: Biophysical Techniques–II
Separation of macromolecules by Electrophoresis, Blotting Techniques & Principle of Centrifugation, Fermentation Technology & Protein Interaction, Bioinformatics and Computational Biology

Module IX: Recombinant DNA Technology–II
Heterologous protein expression of cloned DNA in *E. coli*, Gene transfer, PCR & Recombinant DNA Technology, Genome structure & Transcriptome

Module X: Immunology–II
The response of T cells to antigens, Cytokines & Complement system, Vaccines, Autoimmunity & Transplantation Immunology and Immune Response & Regulation

Module XI: Lab work-IV
Fermentation of microbial products, Chromatographic techniques, Immunoblotting, SDS gel Electrophoresis and Databases

Module XII: Lab work –V
Preparation of competent cells, Transformation, PCR, RAPD, Sequencing and Bioinformatics tools for structure prediction etc.

Module XIII: Lab work –VI
Haemagglutination, ELISA, WIDAL test etc.

Module XIV: Project
The last one month of the course the students will be required to do a project in any topic approved by the Coordinator / Head of the Department of Biotechnology

Department of Biotechnology
Veer Narmad South Gujarat University
Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: I **Module Code: PGD: MB-101**

Module Name: Biophysical Techniques-I

Unit 1: Quantification of Proteins:

1.1. Principles of Spectrophotometry: ultraviolet- visible absorption spectrophotometry
1.2. Visible recording of spectra for proteins and nucleic acids
1.3. Calculation of concentration of protein and nucleic acids from spectrum
1.4. Fluorescence spectroscopy
1.5. Mass spectrometry

Unit 2: Separation of Proteins:

2.1. Thin Layer Chromatography
2.2. Gel Filtration Chromatography
2.3. Ion Exchange Chromatography
2.4. Affinity Chromatography
2.5. Gas Liquid Chromatography

Unit 3: Purification of proteins & Basic concept of Enzyme:

3.1. Protein precipitation by using salts, organic solvents, organic polymers
3.2. Dialysis and Membrane Filtration
3.3. Enzymes: Basic features of Enzyme and Catalysis
3.4. Estimation of, V_{max} and Km using Lineweaver – Burke plot
3.5. Enzyme Inhibition, Specific activity

Unit 4: Tissue Culture:

4.1. **Plant Tissue Culture:** Concept of Totipotency, Callus, Tissue Culture media, Phytohormones, Cybrids
4.2. Cell, Tissue and Organ culture, Somatic Embryogenesis, Organogenesis, Applications (Somatic hybridization, embryo rescue, virus-free plants, somaclonal variations)
4.3. **Animal Tissue Culture:** Primary Culture, Cell Lines, Continuous Cell Lines (transformation, anchorage independence, contact inhibition)
4.4. Set up of Plant and Animal Tissue culture laboratory
4.5. Applications of Tissue Culture

Suggested Reading:

1. Biochemistry and Molecular Biology, Keith Wilson & John Walker (6th Edition, 2008) Cambridge University Press.
2. Physical Biochemistry, Freifelder (2nd Edition, 1982) W. H. Freeman and Co.
3. Principles of Biochemistry, Lehninger, Nelson and Cox (5th Edition, 2008) W. H. Freeman and Co.
4. Modern Industrial Microbiology and Biotechnology, Nduka Okafor (2007) Science Publishers.
5. Plant Tissue Culture Theory and Practice, Bhojwani and Razdan (2008) Elsevier.
6. Culture of Animal Cells, Freshney (4th Edition, 2000) Wiley-Liss Inc.

Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: II **Module Code: PGD: MB-102**

Module Name: Recombinant DNA Technology-I

Unit 1: Restriction Enzymes:

1.1. Types, Properties, Nomenclature
1.2. DNA polymerases: DNA Polymerase I, Klenow fragment, T4 DNA Polymerase, T7 DNA Polymerase
1.3. RNA Polymerases: T3, T7, SP6
1.4. Reverse Transcriptase: AMV, MoMLV
1.5. Ligases: T4 DNA ligase, *E. coli* DNA ligase

Unit 2: Cloning Vectors:

2.1. Biology of plasmids (conjugative, non-conjugative, relaxed and stringent control of copy number, incompatibility)
2.2. Plasmid based vectors (Direct and indirect selection)
2.3. Biology of Lambda phage (lytic versus lysogenic cycle) and M13 bacteriophage,
2.4. λ bacteriophage based vectors (insertional and replacement), *in vitro* packaging and M13 phage based vectors, phagemids.
2.5. High capacity vectors: Cosmids, P1 phage based vectors, PACs, YACs, BACs.

Unit 3: Linkage & DNA Library:

3.1. Creating new restriction sites by DNA manipulation, Linkers, Adapters
3.2. Covalent linkage of DNA fragments to vector molecules: conversion adaptors, homopolymer tailing (recovery of DNA insert after homopolymer tailing).
3.3. Generation of genomic and cDNA libraries (mRNA source, integrity, enrichment techniques, different methods of first strand and second strand of cDNA synthesis)
3.4. Limitations of cDNA synthesis (5'end RACE, 3' end RACE)
3.5. Solid Phase Synthesis of DNA: Phosphoramidite based

Unit 4: DNA Methylation systems & Screening Techniques:

4.1. DNA methylation systems in *E. coli* (dam, dcm)
4.2. Selection and screening of recombinant clones: Radiolabelled probe preparation via nick translation, random priming, 3' end labeling, 5'end labeling, Guessmers and degenerate probes
4.3. Non-radioactive probes preparation using Biotin, Digoxigenin
4.4. Sequence dependent and independent screening: PCR based colony and plaque hybridization, functional screening, immunological screening, gain of function screening.
4.5. HRT & HART

Suggested Reading:

1. Principles of Gene Manipulation and Genomics, S.B. Primrose & R.M. Twyman (7th Edition, 2006) Blackwell Publishing.
2. Molecular Cloning (A Laboratory Manual), Sambrook and Russell (3rd Edition, 2001) CSHL Press.

Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: III **Module Code: PGD: MB-103**

Module Name: Immunology-I

Unit 1: Overview of the Immune System:

1.1. Historical Background, Innate Immunity, Toll Like Receptors
1.2. Organization of the Immune System
1.3. Primary & Secondary Lymphoid Organs
1.4. Myeloid Cells and Lymphoid Cells
1.5. Dendritic Cells and Natural Killer Cells

Unit 2: Antigens & Antibodies:

2.1. Immunogenicity and Antigenicity
2.2. Factors that influence Immunogenicity
2.3. Haptens, Carrier, Epitopes, Cross Reactivity
2.4. Structure of Immunoglobulins, Immunoglobulin subtype, B cell receptor, Isotype, Allotype, Idiotype
2.5. Monoclonal Antibodies

Unit 3: Antigen Antibody Interactions:

3.1. Affinity, Avidity, Cross reactivity, Precipitation Reactions, Agglutination Reactions
3.2. Immunofluorescence, Fluorescence activated cell sorter, Complement Tests, ELISA, RIA
3.3. The Major Histocompatibility Complex: Structure and cellular distribution of MHC molecules
3.4. Peptide binding by MHC, MHC and Immune responsiveness
3.5. Antigen Processing and Presentation: Cytosolic and Endocytic Pathway

Unit 4: B Cell Biology & Antibody Diversity:

4.1. The response of B cells to antigen: B cell maturation, activation and proliferation
4.2. Signaling pathways leading to B cell activation, Germinal centers
4.3. Formation of Plasma cells, Memory cells, Class Switching
4.4. Generation of Antibody Diversity: Multi Gene Organization of Immunoglobulin Genes
4.5. Mechanism of Gene Rearrangement

Suggested Reading:

1. Immunology, Janis Kuby (6^{th} Edition, 2007) Freeman and Company.
2. Immunobiology, Janeway, Travers, Walport, Sclomchik (6^{th} Edition, 2005) 9 Garland publishing.

Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: IV **Module Code: PGD: MBL-104**

Module Name: Lab work-I

1. Spectrophotometeric analysis of nucleic acids
2. Protein estimation at λ_{280}
3. Ammonium sulphate fractionation and dialysis
4. To study time course reaction and determine optimum pH/Temperature for an enzyme
5. Preparation of double reciprocal curve of an enzyme
6. Qualitative analysis of important phytochemicals
7. Isolation of protoplast
8. Demonstration: Ion Exchange Chromatography, Affinity Chromatography, Reverse Phase Chromatography.

Suggested Reading:

1. The Tools of Biochemistry, Terrance G. Cooper (2011) Wiley Interscience.
2. Purifying Proteins for Proteomics, Richard J. Simpson (2004) CSHL Press.
3. Molecular Cloning (A Laboratory Manual), Sambrook and Russell (3rd Edition, 2001) CSHL Press.

Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: V **Module Code: PGD: MBL-105**

Module Name: Lab work-II

1. Obtaining isolated colonies of *E. coli* by streak plate and spread plate method and study the growth curve of *E. coli*
2. Isolation of chromosomal DNA of *E. coli* and Gel Electrophoresis
3. Isolation of plasmid DNA and Gel Electrophoresis
4. Isolation of DNA from plant source
5. Digestion of DNA with restriction enzymes
6. Determination of molecular weight of unknown DNA sample by Agarose Gel Electrophoresis
7. Estimation of DNA by DPA method
8. Estimation of RNA by Orcinol method

Suggested Reading:

1. Molecular Cloning (A Laboratory Manual), Sambrook and Russell (3^{rd} Edition, 2001) CSHL Press.
2. Gene Cloning and DNA Analysis, T. A. Brown, (6^{th} Edition, 2010) Blackwell Publishing.
3. Prescott, Harley and Klein's Microbiology, Wiley, Sherwood, Woolverton (7^{th} Edition, 2008) McGraw Hill.

Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: VI **Module Code: PGD: MBL-106**

Module Name: Lab work-III

1. Identification of human blood groups and Rh factor
2. Isolation of splenocytes from spleen tissue
3. Isolation of peripheral blood mononuclear cells (PBMC)
4. Assessment of cell viability by Trypan Blue
5. To perform Immunodiffusion assay: Single diffusion
6. To perform Immunodiffusion assay: Double Diffusion
7. To perform Immunoelectrophoresis
8. Demonstration of Immunoblotting

Suggested Reading:

1. Practical Immunology, Hudson & Hay (4th Edition 2002) Blackwell Publishing.
2. Handbook of Immunoprecipitation, Nils H. Axelsen (1984) Blackwell Publishing.

Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: VII **Module Code: PGD: MBL-107**

Module Name: Seminar

Each student is required to deliver a seminar on any Molecular & Biochemical technology topic approved by the Coordinator/ Head of the Department of Biotechnology.

Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: VIII **Module Code: PGD: MB-201**

Module Name: Biophysical Techniques–II

Unit 1: Separation of Macromolecules by Electrophoresis:

1.1. Native and SDS PAGE
1.2. Detection of protein bands in gels- Coomassie blue staining, silver staining, fluorescence staining, affinity staining
1.3. Isoelectric Focusing of Proteins, Two Dimensional Gel Electrophoresis
1.4. Gradient Gel Electrophoresis, Differential Gel Electrophoresis (DIGE)
1.5. Theory of Agarose Gel Electrophoresis and Pulsed Field Gel Electrophoresis

Unit 2: Blotting Techniques & Principle of Centrifugation:

2.1. Southern Blot and factors affecting DNA transfer
2.2. Northern Blot, Western Blot, Dot Blot
2.3. Centrifugation: Principle, instrumentation and applications
2.4. Radioactive materials: Types, precautions for handling, methods of measurements and applications.
2.5. Autoradiography

Unit 3: Fermentation Technology & Protein Interaction:

3.1. Fundamentals of fermentation technology: Batch, Fed Batch and Continuous cultures
3.2. Stirred Tank Reactors and Airlift Fermenters, Downstream Processing
3.3. Additional methods to identify associated proteins: Analysis of protein–protein interactions, Yeast two-hybrid systems
3.4. Analyzing protein interactions by Fluorescence Resonance Energy Transfer (FRET), Protein Fragment Complementation (PCA), Mass Spectroscopy (MS)
3.5. Library based methods (surface display) Protein microarrays

Unit 4: Bioinformatics and Computational Biology:

4.1. Biological databases and Archives: Sequence Databases, Structure Databases, Microbial Databases and Eukaryotic Databases
4.2. Genomics: ORF, promoters, ESTs, Genome Analysis, Gene Prediction, Statistical Models, Mathematical Models, Sequence Alignment
4.3. Comparative Genomics
4.4. Proteomics: Protein Structure Prediction, Homology Models, Threading/Fold Recognition
4.5. *Ab-Initio* Models, Protein-Protein Interactions, Proteins as Drug Targets, Phylogenetic Analysis

Suggested Reading:

1. Biochemistry and Molecular Biology, Keith Wilson & John Walker (6^{th} Edition, 2008) Cambridge University Press.
2. Biochemistry Laboratory: Modern Theory and Techniques, Rodney Boyer (International Edition, 2009) Benjamin Cummings.
3. Physical Biochemistry, Freifelder (2^{nd} Edition, 1982) W. H. Freeman and Co.

4. Principles of Biochemistry, Lehninger, Nelson and Cox (5th Edition, 2008) W. H. Freeman and Co.
5. Modern Industrial Microbiology and Biotechnology, Nduka Okafor (2007) Science Publishers.
6. Introduction to Bioinformatics, Attwood, Parry- Smith, Phukan (2007) Pearson Education.
7. Bioinformatics, David Mount (2001) CSHL Press.
8. Plant Tissue Culture Theory and Practice, Bhojwani and Razdan (2008) Elsevier.
9. Culture of Animal Cells, Freshney (4th Edition, 2000) Wiley-Liss Inc.

Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: IX **Module Code: PGD: MB-202**

Module Name: Recombinant DNA Technology –II

Unit 1: Heterologous protein expression of cloned DNA in *E. coli:*

1.1. Expression vectors (*lac* promoter, *trp* promoter, Lambda cI promoter, arabinose promoter based)
1.2. Optimization of protein expression (using upstream and downstream signals)
1.3. Fusion proteins, cell-free translation systems.
1.4. RNAi vectors.
1.5. DNA transformation in yeast: Methods of gene transfer to yeast, YIp, YEp, YCp, YRp, shuttle vectors)

Unit 2: Gene Transfer:

2.1. Methods of Gene transfer to plants
2.2. Gene transfer to animal cells
2.3. Optimization of protein synthesis
2.4. Use of reporter genes.
2.5. Characterization of cloned DNA: Restriction Mapping, DNA Sequencing (Dideoxy Chain Termination, Chemical Degradation, Pyrosequencing, Shotgun Sequencing and Contig Assembly**)**

Unit 3: PCR & Recombinant DNA Technology

3.1. Polymerase Chain Reaction, RAPD
3.2. Primer Designing
3.3. DNA Markers
3.4. Modification of cloned DNA
3.5. Applications of Recombinant DNA Technology: Transgenic animals, Transgenic plants, Gene therapy, Pharmaceutical products

Unit 4: Genome structure & Transcriptome:

4.1. Organization of genomes and nuclear DNA
4.2. Mapping and Sequencing genomes.
4.3. Analysis of the transcriptome: RNA expression level profiling with microarrays, MPSS, SAGE, ESTs, loss of function
4.4. Knock out, knock down, antisense RNA and RNA
4.5. Safety of Recombinant DNA Technology and Ethical issues

Suggested Reading:

1. Principles of Gene Manipulation and Genomics, S.B. Primrose & R.M. Twyman (7th Edition, 2006) Blackwell Publishing.
2. Molecular Cloning (A Laboratory Manual), Sambrook and Russell (3rd Edition, 2001) CSHL Press.

Diploma Course: Molecular & Biochemical Technology

Syllabus

Module: X **Module Code: PGD: MB-203**

Module Name: Immunology –II

Unit 1: The Response of T cells to antigens:

1.1. T cell receptor, T cell accessory membrane molecules, thymic selection of T cell repertoire
1.2. Organization and rearrangement of TCR genes
1.3. Cell mediated immune response: generation of cytotoxic cells
1.4. CTL mediated cytotoxicity
1.5. Response of NK cells

Unit 2: Cytokines & Complement System:

2.1. Cytokines: properties, function of IL -1 to IL-5, IL-10, Il-12, IFNs, TNFs
2.2. Cytokine receptors and signal
2.3. Cytokine related diseases
2.4. Classical & Alternate pathway and Lectin pathway & Regulation
2.5. Biological consequences of complement activation

Unit 3: Vaccines, Autoimmunity & Transplantation Immunology:

3.1. Active and passive immunization, attenuated & inactivated vaccines
3.2. New approaches to vaccine development
3.3. Organ specific and systemic autoimmune diseases
3.4. Types of grafts, tissue typing
3.5. Immunological basis of graft rejection, immunosuppressive therapy

Unit 4: Immune Response & Regulation:

4.1. Immune response to Bacterial, Viral, Protozoan and Helminth infections
4.2. Genomics and the challenge of infectious diseases
4.3. Oncogenes, Tumor antigens and Induction of immune response
4.4. Immunotherapy for tumors
4.5. Antigen & antibody mediated regulation, Jerne's theory

Suggested Reading:

1. Immunology, Janis Kuby (7^{th} Edition, 2006) Freeman and Company.
2. Immunobiology, Janeway, Travers, Walport, Sclomchik (6^{th} Edition, 2005) Garland publishing.

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Module: XI **Module Code: PGD: MBL-204**

Module Name: Lab work –IV

1. SDS PAGE of proteins and determination of molecular weight of protein samples
2. Enzyme ad Secondary metabolite production by microorganisms (Amylase, Citric acid)
3. Databases: Protein data bank, Nucleic acid database, Genbank, Sequence alignment using BLASTn, BLASTp, CLUSTALW. Phylogenetic analysis and development of dendrogram and cladogram
4. Gene finding tools- GenScan, GLIMMER
5. Introduction to proteomics Protparam, GOR, nnPredict, SWISSMODEL
6. Protein Visualization Softwares - Rasmol, JMOL

Suggested Reading:

1. The tools of Biochemistry, Terrance G. Cooper, Wiley Interscience.
2. Purifying Proteins for Proteomics, Richard J. Simpson, CSHL Press.
3. Introduction to Bioinformatics, Attwood, Parry- Smith, Phukan (2007) Pearson Education.
4. Bioinformatics, David Mount (2001) CSHL Press.

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Module: XII **Module Code: PGD: MBL-205**

Module Name: Lab work –V

1. Preparation of competent cells of *E. coli* and transformation of competent *E. coli* cells with plasmid DNA.
2. To amplify a gene using PCR
3. Primer Designing by Bioinformatics tools.
4. Soil DNA extraction by Spin Column method
5. Total bacterial RNA isolation and separation by Electrophoresis
6. Demonstration of RAPD and DNA sequencing by different methods.

Suggested Reading:

1. Molecular Cloning (A Laboratory Manual), Sambrook and Russell (3rd Edition, 2001) CSHL Press.
2. Gene Cloning and DNA Analysis, T. A. Brown, (6th Edition, 2010) Blackwell Publishing.

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Module: XIII **Module Code: PGD: MBL-206**

Module Name: Lab work –VI

1. Isolation and titration of Bacteriophage
2. WIDAL Slide test
3. Detection of HIV by ELISA test
4. Detection of Hepatitis B surface antigen by direct ELISA
5. Hemagglutination test to check blood donor feasibility
6. Complement fixation test

Suggested Reading:

1. Practical Immunology, Hudson & Hay (4th Edition, 2002) Blackwell Publishing.
2. Handbook of Immunoprecipitation, Nils H. Axelsen (1984) Blackwell Publishing.

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Module: XIV **Module Code: PGD: MBP-101**

Module Name: Project

The last one month of the course the students will be required to do a project in any topic approved by the Coordinator / Head of the Department of Biotechnology.