Al-Qasim Green University

College of Biotechnology/ Department of Genetic Engineering

Year: Third
Subject: Applied Molecular Biology
Theoretical hours: 2
Practical hours : 2
Units : 3

Applied Molecular Biology ……. (Theoretical Syllabus)

Course module description:

This module is a major (Mandatory) Departmental course for third Year in genetic engineering department. The module starts with description the basic techniques essential to molecular biology and explained by putting them in the context of the impact which molecular Biology is having upon modern main stream biology.

Course module academic calendar

week	Basic material to be covered	Hours
1	Review: Flow of Genetic information---Central dogma, Recognition of DNA as genetic material	2
2	Overview on DNA cloning techniques,	2
3	Molecular cloning, methods and tools for studying genes and gene activity	2
4	Molecular cloning, methods and tools for studying genes and gene activity	2
5	Molecular cloning, methods and tools for studying genes and gene activity	2
6	Introduction to gene manipulation: DNA cloning, restriction enzymes and maps	2
7	Conventional PCR technique	2
8	Conventional PCR technique	2
9	Real time PCR technique	2
10	Real time PCR technique	2
11	Methods in DNA sequencing	2
12	Overview: Transcription &posttranscriptional modification in prokaryotic	2
13	Site Directed mutagenesis	2
14	Nothern Blot	2
15	DNA arrays, Mapping transcripts:-Primer extension -S1 mapping	2

Applied Molecular Biology ……. (Practical Syllabus)

. **Course module academic calendar**

week	Basic material to be covered	Hours
1	Subject will be covered	2
2	DNA extraction and purification	2
3	RNA extraction and purification	2
4	Gel electrophoresis	2
5	Gel electrophoresis	2
6	Conventional PCR technique	2
7	Conventional PCR technique	2
8	Real time PCR technique	2
9	Other PCR technique	2
10	Methods in DNA sequencing	2
11	Methods in DNA sequencing	2
12	gene manipulation: DNA cloning, restriction enzymes and maps	2
13	Northern Blot	2
14	DNA arrays	2
15	DNA arrays, Mapping transcripts:-Primer extension -S1 mapping	2

Text Books :

References :

Al-Qasim Green University

College of Biotechnology/ Department of Genetic Engineering

year: fourth

subject: Bioinformatics

Units : 3

(Theoretical Syllabus)

Course module description:

Bioinformatics : An introduction to the Bioinformatics . Lectures also includes Bioinformatics database, Molecular biology and computational sequence analysis.

week	Basic material to be covered	Hours
1	Introduction of bioinformatics	2
2	Molecular biology and computational sequence analysis	2
3	Bioinformatics database	2
4	Biomolecule database	2
5	Metabolic database	2
6	Genetic database	2
7	Mid exam	2
8	PDB(protein database bank)	2
9	KEGG(Kyoto Encyclopedia of genes and genomes)	2

10	Silva database	2
11	MEGA program	2
12	Bioedite	2
13	Mutation surveyor program	2
14	In silico PCR amplification	2

Al-Qasim Green University

College of Biotechnology - Department of Genetic engineering

Course title: Bioinformatics

Course level: undergraduate

Number of units: 3

Course module description:

Within the last 20 years there has been a literal explosion in the quantity and variety of information in molecular biology. In order to cope with this ocean of data, molecular biologists have had to develop new tools that rely heavily on the power of statistics and computing yet still incorporate an understanding of the underlying biological principles. The development and application of these tools in conjunction with assembled databases of biological information has become a field of its own, known as either Bioinformatics or as Computational Biology. In the course Bioinformatics, we explore the principles underlying the analyses of sequence and molecular databases and work to provide students with the understanding and practical experience for intelligent and efficient application of these tools. we focus primarily on the analysis of nucleic acid sequences. We expand these studies to include gene prediction, protein function and structure studies and analysis of whole genomes.

Course Goals: There are two major goals for this course. First, we want students to understand both the advantages and the limitations of a Bioinformatics approach to molecular biology. This requires that students understand the underlying principles for each technique and realize where compromises have been made and why. Second, we want students to have practical experience in the application of specific tools to research problems. This experience will include working in multiple computer environments, including Unix, Perl, and making use of specific web-based and computer based software tools including the Genetics Computer Group (GCG) suite.

Theoretical syllabus

Week	Subject	Hrs
1	Introduction, what is bioinformatics, goals, scope, applications, limitations	2
2	Introduction to biological databases, what is a databases, types of databases, biological databases, pitfalls of biological databases, information retrieval from biological databases	2
3	Sequences alignment, Pairwise Sequence Alignment, Database Similarity Searching, Multiple Sequence Alignment	2
4	Gene and promoter prediction, Gene Prediction, Promoter and Regulatory Element Prediction,	2
5	Molecular phylogenetic, Phylogenetics Basics, Phylogenetic Tree Construction Methods and Programs	2
6	First exam	2
7	Structural bioinformatics, Protein Structure Basics, protein Structure Visualization, Comparison, and Classification	2
8	Structural bioinformatics, Protein Secondary Structure Prediction, Protein Tertiary Structure Prediction	2
9	Structural bioinformatics, RNA Structure Prediction	2
10	Genomic and proteomics, Genome Mapping, Assembly, and Comparison	2
11	Second exam	2
12	Genomics and proteomics, Functional Genomics	2
13	Genomics and proteomics, Proteomics, Technology of Protein Expression Analysis, Posttranslational Modification, Protein Sorting, Protein–Protein Interactions	2
14	Practical exercises	2
15	Final exam	2

Practical syllabus

week	Subject	Hrs
1	Introduction to Bioinformatics and Sequence Analysis,	2
2	Introduction to Internet Resources, The NCBI Website and ENTREZ, PubMed, Gene Name Evolution, The Gene Database, Retrieving Nucleotide Sequences	2
3	Introduction to the BLAST Suite and BLASTN, What is BLAST?, BLAST Results, BLASTN Across Species, BLAST Output Format	2
4	Protein BLAST: BLASTP, BLASTP and the Scoring Matrix, An Example BLASTP Search,	2
5	Cross-Molecular Searches: BLASTX and TBLASTN, Messenger RNA Structure, BLASTX	2

6	First exam	2
7	Advanced Topics in BLAST, Reciprocal BLAST: Confirming Identities, Adjusting BLAST Parameters	2
8	Bioinformatics Tools for the Laboratory, Restriction Mapping and Genetic Engineering	2
9	PCR and Primer Design Tools, Primer3, Primer-BLAST,	2
10	Multiple Sequence Alignments, Multiple Sequence Alignments Through NCBI BLAST, ClustalW from the ExPASy Website, ClustalW at the EMBL-EBI Server	2
11	Second exam	2
12	Modifying ClustalW Parameters	2
13	Comparing ClustalW, MUSCLE, and COBALT	2
14	Isoform Alignment Problem: Internal Splicing, Manually Editing a Multiple Sequence Alignment	2
15	Final exam	2

*Methods of instruction

1) using the lecture method with participation the pupils in discussion
2) using of recent methods in presentation the lectures by power point.
3) coordination of concepts of practical experiments with theoretical concepts.

*Course degrees' distribution:

Theory: 24

Practical: 16

*Refrencess

Practical Bioinformatics. First edition by Michael Agostino. (2012). ISBN: 9780815344568
Essential bioinformatics. First edition by Jin Xiong. Cambridge University Press (20026). isbn-13 978-0-511-16815-4
Bioinformatics: sequence and genome analysis. Second edition by David W Mount. Cold Spring Harbor Laboratory Press (2004) ISBN: 978-087969712-9
The Phylogenetic Handbook: A Practical Approach to Phylogenetic Analysis and Hypothesis Testing. Second edition. Edited by Philippe Lemey, Marco Salemi and Anne-Mieke Vandamme. Cambridge University Press (2009) ISBN: 978-0521730716

Al-Qasim Green University

College of Biotechnology/ Department of Genetic Engineering

Year: fourth
subject: Bioseperation
Theoretical hours :2
Practical hours: 2
Units : 3

Course module description:tis course discuss bioseparation techniques & type of biomolecules, Types of extraction such as concentration / precipitation by neutral salt, organic solvent & dialysis. Ion exchange chromatography, HPLC (high performance liquid chromatography).

(Theoretical Syllabus)

week	Basic material to be covered	Hours
1	Introduction of bioseparation techniques & type of biomolecules	2
2	extraction	2
3	Types of extraction	2
4	concentration / precipitation by neutral salt, organic solvent & dialysis	2
5	concentration / precipitation by neutral salt, organic solvent & dialysis	2
6	Ion exchange chromatography	2
7	Mid exam	2
8	Gel filtration chromatography	2
9	affinity chromatography	2
10	affinity chromatography	2
11	HPLC (high performance liquid chromatography)	2
12	HPLC (high performance liquid chromatography)	2
13	Modern techniques & future respect	2
14	Modern techniques & future respect	2

Bioseperation ……. (Practical syllab

week	Basic material to be covered	Hours
1	Screening and extraction of protease enzyme activity in different sources	2
2	Screening and extraction of protease enzyme activity in different sources	2
3	Concentration: precipitation with ammonium sulfate	2
4	Concentration: precipitation with ammonium sulfate	2
5	Dialysis	2
6	Dialysis	2
7	First step purification by ion exchange	2
8	First step purification by ion exchange	2
9	Second step purification by gel filtration	2
10	Second step purification by gel filtration	2
11	Purity test by SDS PAGE (poly acrylamide gel electrophoresis)	2
12	Purity test by SDS PAGE (poly acrylamide gel electrophoresis)	2
13	Other purification methods	2
14	Other purification methods	2

Books

References

❖

ش

Al-Qasim Green University

College of Biotechnology/ Department of Genetic Engineering

Year: fourth
subject: Gene and disease
Theoretical hours :2
Practical hours: 2
Units : 3

Course module description: this course discuss gene and disease, Molecular Genetic Mechanisms, Diagnosing And Mapping of the disease coding genes ,Experimental Proofs that genes are causing diseases ,Management of human disease causing genes, Molecular Genetics of Human Diseases.

(Theoretical Syllabus)

week	Basic material to be covered	Hours
1	Gene Versus Disease.	2
2	Molecular Genetic Mechanisms	2
3	Molecular Genetic Mechanisms	2
4	Diagnosing And Mapping of the disease coding genes.	2
5	Diagnosing And Mapping of the disease coding genes.	2
6	Mid exam	2
7	Experimental Proofs that genes are causing diseases.	2
8	Experimental Proofs that genes are causing diseases.	2
9	Experimental Proofs that genes are causing diseases.	2
10	Experimental Proofs that genes are causing diseases.	2
11	Management of human diseaes causing genes.	2
12	Management of human diseaes causing genes.	2
13	Molecular Genetics of Human Diseases.	2
14	Molecular Genetics of Human Diseases.	2

Syllabus of Gene and Disease

1	**Molecular Hematological Diseases**
2	Molecular Hematological Diseases
3	SICKLE CELL ANEMIA
4	SICKLE CELL ANEMIA
5	Thalassaemia
6	Mid exame
7	**Leukemia**
8	**Leukemia**
9	PCR
10	PCR
11	Electrophoresis
12	Electrophoresis
13	Application reiew
14	Final eaxame

References

1-Jorde LB , Carey JC , Bamshad MJ ,2010,Medical Gnetics,4th ed. ,Mosby ,Philadelphia.

2-Ochs HD ,Smith CIE , Puck JM 1998,Primary Immunodificiencey Diseases: A Molecular And Genetic Approach ,Oxford University Press ,Oxford

Al-Qasim Green University

College of Biotechnology/ Department of Genetic Engineering

Year: fourth
subject: Nanobiotecology
Theoretical hours :2
Practical hours: 2
Units : 3

Course module description: this course discuss The Science **principles of** Nanobiotechnology, Cellular Nanomachines and the Building Blocks of Life, Introduction to Nanostructures: Carbon Nanotubes (CNT) anFullerenes

(Theoretical Syllabus)

week	Basic material to be covered	Hours
1	Course Introduction: The Science of Nano - What is Nanobiotechnology?	2
2	Cellular Nanomachines and the Building Blocks of Life	2
3	The Nano Perspective and Chemical bond interactions	2
4	The Nano Perspective and Chemical bond interactions	2
5	Nano Fabrication: Top down and Bottom up techniques and synthesis of Nanoparticles	2
6	Nano Fabrication: Top down and Bottom up techniques and synthesis of Nanoparticles	2
7	Mid exam	2
8	Introduction to Nanostructures: Carbon Nanotubes (CNT) anFullerenes	2
9	Quantum Dots and Semiconductor Nanoparticles Metal-based Nanostructures	2
10	Nanowires Polymer-based Nanostructures (Dendrimers)	2
11	Nanowires Polymer-based Nanostructures (Dendrimers)	2
12	Self-assembly: Protein-based Nanostructures,Nanomotors,andNanobiosensors.	2

13	Medical Applications: Nanoparticles' Cytotoxicity	2
14	Nucleoprotein-Based Nanodevices in Drug Design and Delivery	2

Nanobiotecnology ……. (Practical syllab

week	Basic material to be covered	Hours
1	General introduction to Nanotechnology lab	2
2	Characterization techniques	2
3	Top down strategy	2
4	Top down strategy	2
5	Synthesis of silver nanoparticles	2
6	Synthesis of silver nanoparticles	2
7	Mid exam	2
8	Biological application of silver nanoparticles	2
9	Synthesis of Iron Oxide nanoparticles	2
10	Biological application of iron oxide nanoparticles	2
11	Bottom up strategy.	2
12	Bottom up strategy.	2
13	synthesis of carbon nanotube	2
14	Biological application of carbon nanotube	2