

## **MIT2.1 Design Patterns and J2EE**

### **Course Objectives:**

J2EE is a widely used Framework in Software Development. The objective of the course is to enable the student to gain mastery in various advanced J2EE patterns used in Software Industry.

### **Instructional Objectives:**

To know the major Software Design Patterns available in J2EE framework to meet demanding Software Engineering problems encountered in various Industries.

To get hands on experience working with the various J2EE patterns and Anti Patterns.

### **Module I**

**Creational Patterns :** Abstract Factory, Singleton

**Structural Patterns:** Adaptor, Bridge

**Behavioral Patterns:** Chain of Responsibility, Command, Iterator

### **Module II**

**J2EE Presentation Tier Patterns:** Presentation Tier Design Considerations and Anti Patterns, Intercepting Filter, Front Controller, Context Object, Application Controller

### **Module III**

**J2EE Business Tier Design Considerations and Anti Patterns:** Business Delegate, Service Locator, Session Façade, Application Service, Business Object, Composite Entity

### **Module IV**

**J2EE Integration Tier Design Patterns:** Data Access Object, Service Activator, Domain Store, Web Service Broker,

### **TextBooks:**

1. Design Patterns, Elements of Reusable Object Oriented Software by Eric Gamma, Richard Helm, Ralph Johnson, John Vissides, ISBN:978-81-317-0007-5
2. Core J2EE Patterns – Best Practices and Design Strategies by Deepak Alur, John Crupi, Dan Marks, Second edition, ISBN: 978-81-7758-671-8

## MIT 2.2 Data Mining and Warehousing

### **Course Objectives:**

The course introduces database and data mining concepts with emphasis on data analysis. It explains the concepts and techniques with algorithms and examples that underlie classification, prediction, association, and clustering. The course also gives an insight into the various applications and trends in data mining.

### **Instructional Objectives:**

At the end of the course the student should be in a position to Understand and apply data mining in real life applications in various fields.

### **Module I**

Introduction: Why Data Mining? What Is Data Mining? What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used? Which Kinds of Applications Are Targeted? Major Issues in Data Mining.

Getting to Know Your Data : Data Objects and Attribute Types ,Basic Statistical Descriptions of Data, Data Visualization ,Measuring Data Similarity and Dissimilarity  
Data Preprocessing: Data Preprocessing: An Overview Data Cleaning, Data Integration, Data Reduction , Data Transformation and Data Discretization .

### **Module II**

Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP ,Data Warehouse Design and Usage , Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction

Data Cube Technology : Data Cube Computation: Preliminary Concepts, Data Cube Computation Methods ,Processing Advanced Kinds of Queries by Exploring Cube Technology, Multidimensional Data Analysis in Cube Space .

Mining Frequent Patterns, Associations, and Correlations Basic Concepts and Methods: Basic Concepts, Frequent Itemset Mining Methods, Which Patterns Are Interesting?— Pattern Evaluation Methods.

Advanced Pattern Mining: Pattern Mining: A Road Map ,Pattern Mining in Multilevel, multidimensional Space , Constraint-Based Frequent Pattern Mining ,Mining High-Dimensional Data and Colossal Patterns ,Mining Compressed or Approximate Patterns ,Pattern Exploration and Application .

### **Module III**

Classification: Basic Concepts: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection ,Techniques to Improve Classification Accuracy .

Classification: Advanced Methods: Bayesian Belief Networks, Classification by Backpropagation  
Support Vector Machines, Classification Using Frequent Patterns, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods, Additional Topics Regarding Classification.

#### **Module IV**

Cluster Analysis: Basic Concepts and Methods: Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering.

Advanced Cluster Analysis: Probabilistic Model-Based Clustering, Clustering High-Dimensional Data Clustering, Graph and Network Data, Clustering with Constraints

Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches Proximity-Based Approaches ,Clustering-Based Approaches ,Classification-Based Approaches ,Mining Contextual and Collective Outliers ,Outlier Detection in High-Dimensional Data.

Data Mining Trends and Research Frontiers: Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications ,Data Mining and Society ,Data Mining Trends .

#### **Text Books:**

1. Data Mining Concepts and Techniques Third Edition Jiawei Han and Micheline Kamber Morgan Kaufmann Publishers (ISBN- 978-0-12-381479-1)
2. Principles of Data Mining, Hand, Mannila and Smyth.(ISBN- 978-81-203-2457-2)
3. Introduction to Building the Data Warehouse, IBM, PHI. (ISBN- 81-203-2343-2)
4. Building the Data Warehouse Inmon,W.H 3<sup>rd</sup> edition John Wiley & sons New York. (ISBN- 81-265-0271-1)

## MIT2.3 Artificial Intelligence and Neural network

### Course Objectives:

Artificial Intelligence is the area of computer science focusing on creating machines that can engage on behaviors that humans consider intelligent. The course focuses on various aspects like knowledge representation, machine learning, expert system design, neural networks and different automated reasoning methods using PROLOG and LISP.

### Instructional Objectives

**Upon successful completion of the course, the student must be able to:**

- Understand the challenges and the usefulness of Artificial Intelligence.
- Appreciate the issues involved in knowledge bases, reasoning systems, and planning
- Understand the various search algorithms.
- Understand the area of inference in first-order predicate logic.
- Implement a simple PROLOG and LISP Program
- Understand the potential and current research issues in Artificial Intelligence

### **Module I**

Overview of AI Application Areas

**Predicate Calculus:** The propositional calculus, predicate calculus, Using inference rules to produce predicate calculus expressions.

**Structures and strategies for state space search:** Graph theory, strategies for state space search

**Control and implementation of state space search:** Recursion-based search, Pattern-based search.

**Knowledge Representation:** Issues in knowledge representation, Brief history of AI representation systems, Conceptual graphs, alternatives to explicit representation

### **Module II**

**Strong method problem solving:** overview of expert system technology, Rule based expert system, Model based, case based and hybrid systems, planning.

**Reasoning in uncertain situation:** Logic based abductive inference, Abduction: alternatives to logic.

### **Module III**

**Machine learning - symbol based:** A framework for symbol based learning, version space search, Inductive bias and learn ability, unsupervised learning, Reinforcement learning.

**Machine Learning - Connectionist:** Foundation of connectionist network, Perceptron learning, Backpropagation learning, competitive learning, Hebbian coincidence Learning.

### **Module IV**

**Automated Reasoning:** Introduction to weak methods in Theorem proving, The general problem solver and difference table, Resolution in theorem proving, Prolog and automated reasoning.

**An introduction to prolog :**Syntax for predicate calculus programming, Abstract data types (ADT's)in PROLOG, production system examples in PROLOG, a PROLOG planner, meta-predicates types and unification

**An introduction to LISP:** A brief overview, Search in LISP, Higher-order functions and Procedural Abstraction, Search strategies in LISP, Pattern matching in LISP, a recursive unification function.

### **Text book:**

1. Artificial Intelligence structure and strategies for complex problem solving(fourth edition) by George F. Luger , Pearson publication (ISBN-10: 81-7808-491-0)

### **Reference Books:**

1. Artificial Intelligence with common Lisp -- fundamentals of symbolic and numeric processing by James L. Noyes ,( ISBN -16: 9780669194739)
2. Prolog Programming for Artificial Intelligence by Ivan Brakto , Pearson Education
3. Neural Network a classroom approach by Satish Kumar, TMH (ISBN-16: 978-0-07-048292-0 )
4. Artificial Intelligence by Elaine Rich and Kevin Knight, TMH (ISBN- 0-07-46-00818)
5. The quest for Artificial intelligence by Nils J. Nilsson
6. Artificial Intelligence, a Modern Approach by Stuart Russell and Peter Norvig(ISBN- 81-7808-5542)

## **MIT 2.4 INTERNET SECURITY**

### **Course Objectives:**

This course provides a practical survey of both the principles and practice of cryptography and network security. First, the basic issues to be addressed by a network security capability are explored through a survey of cryptography and network security technology. Then, the practice of network security is explored via practical applications that have been implemented and are in use today

This course includes coverage of the latest topics including expanded coverage of block cipher modes of operation, including authenticated encryption; revised and expanded coverage of AES; expanded coverage of pseudorandom number generation; new

coverage of federated identity, HTTPS, Secure Shell (SSH) and wireless network security.

### **Instructional Objectives:**

At the end of the course the student will be able to:

- Protect data and resources from disclosure,
- Guarantee the authenticity of data and messages,
- Protect systems from network-based attacks.

### **Module I**

**Computer Security Concepts:** The OSI Security Architecture, Security Attacks, services and mechanisms

**Symmetric ciphers:** model, substitution, transposition techniques, Block Ciphers and the Data Encryption Standard: principles, data encryption standard, The Strength of DES

**Basic Concepts in Number Theory:** Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic

**Advanced Encryption Standard:** AES Structure, AES Round Functions, AES Key Expansion, AES Implementation

**Block Cipher Operation:** Multiple Encryption and Triple DES, Electronic Codebook Mode, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode

### **Module II**

**Pseudorandom Number Generation and Stream Ciphers:** Principles of Pseudorandom Number Generation, Pseudorandom Number Generators, Pseudorandom Number Generation Using a Block Cipher, Stream Ciphers, RC4.

**Asymmetric Ciphers:** Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms

**Public-Key Cryptography and RSA:** Principles of Public-Key Cryptosystems, The RSA Algorithm

**Cryptographic Hash Functions:** Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3

**Digital Signatures:** Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital Signature Scheme, Digital Signature Standard (DSS)

### **Module III**

**Key Management and Distribution:** Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure

**User Authentication Protocols:** Remote User Authentication Principles, Remote User Authentication Using Symmetric Encryption, Kerberos, Remote User Authentication Using Asymmetric Encryption, Federated Identity Management

#### **Module IV**

**Transport-Level Security:** Web Security Issues, Secure Sockets Layer (SSL), Transport Layer Security (TLS), HTTPS, Secure Shell (SSH)

**Wireless Network Security:** IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End Security

**Electronic Mail Security:** Pretty Good Privacy (PGP), S/MIME

**IP Security:** IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

#### **Text Books:**

Cryptography and Network Security: Principles and Practice by William Stallings  
5<sup>th</sup> Edition Pearson Education, ISBN 10: 0-13-609704-9, ISBN 13: 978-0-13-609704-4

#### **Reference Books:**

1. Cryptography and Network Security- Behrouz A. Forouzan and DebdeepMukhopadhyayMcGrawHill 2<sup>nd</sup> Edition ISBN-13:978-0-07-070208-0, ISBN-10: 0-07-070208-X
2. Practical Unix & Internet Security, by Grafinkel, Spafford, Schwartz 2nd edition – O'Reilly Publication ISBN-81-7366-683-0
3. Building Internet Firewalls – Ziwick, Cooper and Chapman O'Reilly Publication ISBN-81-7366-101-4

### **MIT 2.5.a Embedded Systems and Sensor Networks**

#### **Course Objectives:**

The Hardware and software approach is dealt equally in this subject.

#### **Instructional Objective:**

At the end of the curriculum learning students will get the start to evaluate the different embedded systems and design the same with the structured programming approach.

#### **Module I**

**Introduction:** Embedded systems Overview, Design Challenges, Processor Technology, IC Technology, Design Technology, Trade-offs

**Custom Single-Purpose Processors:** Hardware, Introduction, Combinational Logic, Sequential Logic, Custom Single-Purpose Processor Design, RT-Level Custom Single-Purpose Processor Design, Optimizing Custom Single-Purpose Processors

## **Module II**

**General-Purpose Processors:** Software, Introduction, Basic Architecture, Operation, Programmer's View, Development Environment, Application-Specific Instruction-Set Processors (ASIPs), Selecting a Microprocessor, General-Purpose Processor Design

**Standard Single-Purpose Processors:** Peripherals, Introduction, Timers, Counters, and Watchdog Timers, UART, Pulse Width Modulators, LCD Controllers, Keyboard Controllers, Stepper Motor Controllers, Analog-to-Digital Converters, Real-Time Clocks

## **Module III**

**Memory:** Introduction, Memory Write Ability and Storage Permanence, Common Memory Types, Composing Memory, Memory Hierarchy and Cache, Advanced RAM

**Interfacing:** Introduction, Communication Basics, Microprocessor Interfacing: I/O Addressing, Microprocessor Interfacing: Interrupts, Microprocessor Interfacing: Direct Memory Access, Arbitration, Multilevel Bus Architectures, Advanced Communication Principles, Serial Protocols, Parallel Protocols, Wireless Protocols

## **Module IV**

**State Machine and Concurrent Process Models:** Introduction, Models vs. Languages, Text vs. Graphics, An Introductory Example, A Basic State Machine Model: Finite-State Machines, Finite-State Machines with Datapath Model: FSM/D, Using State Machines, HCFSM and State charts Language, Program-State Machine Model (PSM), The Role of an Appropriate Model and Language, Concurrent Process Model, Concurrent Processes, Communication among Processes, Synchronization among Processes, Implementation, Dataflow Model, Real-Time Systems

**Control Systems:** Introduction, Open-Loop and Closed-Loop Control Systems, General Control Systems and PID Controllers, Software Coding of a PID Controller, PID Tuning, Practical Issues Related to Computer-Based Control, Benefits of Computer-Based Control Implementations

### **Text Book:**

1. Embedded System Design – A unified Hardware/Software Introduction by Frank Vahid and Tony Givargis; Publisher: John Wiley and Sons. (ISBN- 81-265-0837-X)



### **Reference Books:**

1. Embedded Systems: Architecture, Programming and Design by Raj Kamal, Tata McGraw-Hill, India, 2003, ISBN 0-07-049470-3
2. Fundamentals of Embedded Software: Where C and Assembly meet by Lewis Daniel W., Prentice Hall, ISBN 81-203-2375-0

## **MIT2.5.b Design of Web Services and Cloud Computing**

### **Course Objectives:**

The first part of this course will build the basic understanding of the web services and underlying technologies which are needed for functioning of web services. The course will also cover in detail how to build and deploy a web service. Second part will build the understanding about the cloud computing. The course will cover various issues that needs to be addressed before cloud computing can be employed.

### **Instructional Objectives:**

- Studying various technologies needed for the web services
- Understanding web services and learning how to develop them
- Get familiar with cloud computing
- Various issues involved in the effective use of cloud computing

## **Module I**

### **Introducing Web Services**

The Basics of Web Services, Searching for Information, The Next Generation of the Web, Interacting with Web Services, RPC-Oriented Interactions, Document-Oriented Interactions, The Technology of Web Services, Usage Example, XML: The Foundation, WSDL: Describing Web Services, SOAP: Accessing Web Services, UDDI: Publishing and Discovering Web Services, XML for Business Collaboration: ebXML, Web Services versus Other Technologies, Additional Technologies, Vendor Approaches to Web Services.

### **Describing Information: XML**

A Simple Example, Instance and Schema, Data Type and Programming Language, More on XML Schemas and DTDs, Processing XML Documents, Namespaces, Transformation, XSLT, XPath, Document Structure, Mapping Tools, XML Specifications and Information, XML Specifications Related to Web Services.

### **Describing Web Services: WSDL**

WSDL Basics, WSDL Elements, The Extensible WSDL Framework, Defining Message Data Types, Defining Operations on Messages, Mapping Messages to Protocols, Putting It All Together, Importing WSDL Elements, WSDL-Related Namespaces, Extensions for Binding to SOAP.

## Module II

### **Accessing Web Services: SOAP**

A Simple Example, The SOAP Specification, SOAP Envelope, SOAP Header, SOAP Body, SOAP Faults, RPC Convention, Data Type Mapping, HTTP Binding, Version Control, SOAP Message Processing, SOAP Use of Namespaces, Changes in the v1.2 Draft, SOAP Multipart MIME Attachments, SOAP in the Context of Existing Systems, SOAP's Future Directions.

### **Finding Web Services - UDDI Registry:**

The UDDI Organization, The Concepts Underlying UDDI, How UDDI Works, UDDI Data Model, Generic Data, The Business Entity, The Binding Template, The tModel, UDDI SOAP APIs, Inquiry APIs, Publisher APIs, Usage Scenario, Updating the Registry, Retrieving Information, Using WSDL with UDDI, UDDI for Private Use, UDDI Support for SOAP, Complex Business Relationships, and Unicode, SOAP, Unicode.

### **Implementing Web Services:**

Implementation Architectures, The Major Implementation Streams, Microsoft's .NET, J2EE and Application Servers, Application Server Vendor View, Java APIs for Web Services, J2EE Initiatives for Additional Technologies, Understanding .NET versus J2EE, Vendor Views on Adoption of Web Services Technologies, The Questionnaire, BEA Systems, Cape Clear, Hewlett-Packard, IBM, IONA, Microsoft, Oracle, Sun Microsystems, Systinet, Implementations of ebXML.

## Module III

**Defining Cloud Computing:** Cloud Type, Examining the characteristics of Cloud computing, assessing the Role of Open Standards

**Assessing the Value Proposition:** Measuring the Cloud's Value, Avoiding Capital Expenditures, Computing the Total Cost of Ownership, Specifying Service Level Agreements, Defining Licensing Models

**Understanding Cloud Architecture:** Exploring the Cloud Computing Stack, Connecting to the Cloud

**Understanding Services and Applications by Type:** Defining Infrastructure as a Service (IaaS), Defining Platform as a Service (PaaS), Defining Software as a Service (SaaS), Defining Identity as a Service (IDaaS), Defining Compliance as a Service (CaaS)

## Module IV

**Understanding Abstraction and Virtualization:** Using Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Understanding Machine Imaging, Porting Applications.

**Capacity Planning:** Capacity Planning, Defining Baseline and Metrics, Network Capacity, Scaling

**Exploring Platform as a Service:** Defining Services, Using PaaS Application Frameworks

**Understanding the cloud security:** Securing the Cloud, Securing Data, Establishing Identity and Presence

**Suggestions for the practical sessions:**

Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services:

### **Text Books:**

1. Book Understanding Web Services: XML, WSDL, SOAP, and UDDI By Eric Newcomer ISBN: 0201750813
2. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt Ltd, ISBN: 8126529806

### **Reference Books:**

1. Web Services: Concepts, Architectures and Applications (Data-Centric Systems and Applications) by Gustavo Alonso, Fabio Casati, Harumi Kuno and Vijay Machiraju, ISBN: 978-3540440089, 2004 edition.
2. Cloud Computing by Dr. Kris Jamsa, ISBN: 1449647391

## **MIT2.5.c BIOINFORMATICS**

### **Course Objectives:**

This course provides a comprehensive introduction to the field of bioinformatics that will allow students, researchers, and even enthusiasts interested in the use of computers in biological research to better grasp this dynamic and fast emerging area. The course adopts an integrated approach because of the interdisciplinary nature of the subject, for developing skills in sequencing and analysing genomes of various organisms.

### **Instructional Objectives:**

At the end of this course, the student will learn the following:

- Solutions to problems in molecular biology through computational methods.
- Tools for sequence and structure analysis requiring minimal computational algorithms.
- Sequence alignment, alignment of multiple sequences and phylogenetic analysis with illustrations and examples.
- Genomics: Gene prediction, gene mapping, sequence assembly and gene expression.
- Proteomics: visualization and prediction of protein structure.
- Concept of E-cell.

- Database searches and web information sources, applications of bioinformatics and problem solving through tables and illustrations.

### **Module I**

**Bioinformatics - An overview:** Introduction, Objectives, What kind of data is used, Multiplicity of data and redundancy, Major bioinformatics databases, Data integration, Analysis, careers in bioinformatics, reference list of major bioinformatics databases and tools.

**Molecular Biology and Bioinformatics:** What is molecular biology, Systems approach in biology, Central dogma, Important definitions, Problems in molecular approach and the bioinformatics approach, overview of bioinformatics applications.

**The Information Molecules and Information Flow:** Introduction, basic components, basic chemistry of nucleic acids, structure of DNA, structure of RNA, DNA replication is semi-conservative, Denaturation and renaturation of DNA, Genes, Organisation of genes in eukaryotic chromosomes, structure of bacterial chromosomes, Analysing DNA, Cloning methodology, DNA sequencing and PCR.

**Proteins- Their Structural Profiles and Properties:** Introduction, Amino acids, Protein structure, Secondary structure elements, tertiary structure, Quaternary structure, Protein folding, protein function, Proteins- purification and characterization.

### **Module II**

**Understanding and using Biological Databases:** Introduction, types of databases, networks and databases, introduction to java clients, CORBA, using MYSQL, introduction to biostatistics.

**Alignment of Pairs of Sequences :** Introduction to sequence analysis, Sequence analysis of biological data, models of sequence analysis and their biological motivation, methods of alignment, applications of dot matrices, methods of optimal alignments, using gap penalties and scoring matrices, sensitivity and specificity, illustrative examples.

**Tools for sequence Alignment:** Introduction, Fasta, blast, Filtering and gapped Blast, PSI blast

**Alignment of Multiple sequences:** Introduction, Tools for MSA, Considerations in conducting MSA, Applications of multiple alignment, viewing MSA, Sequence detection efficiency measures.

### **Module III**

**Phylogenetic Analysis:** Introduction, Concept of trees, Phylogenetic trees and multiple alignments, Distance matrix methods, Character based methods, Methods of evaluating phylogenies, summary of phylogenetic methods, steps in constructing alignments and phylogenies, considerations in choice of the method, working with phylogenetic trees.

**Gene Prediction Methods:** Introduction, Using patterns to predict genes, methods of gene prediction, gene prediction tools, summary of tools for DNA/RNA structure and function analysis

**Visualization and Prediction of Protein Structure :** Protein structure overview, different structural proteins, protein structure databases and visualization tools, Protein classification, Protein structure prediction, methods of structure prediction for known folds, methods of structure for unknown folds, Protein function prediction, accuracy of prediction.

#### **Module IV**

**Gene Mapping, Sequence Assembly and Gene Expression :** Introduction, Gene Mapping, Application of Mapping, DNA sequencing, DNA sequencing, Algorithm for alignment of sequencing fragments, DNA microarrays, Microarray experiment design and data analysis.

**Proteomics:** Introduction, Proteome analysis, tools, Metabolic pathways, Genetic networks, network properties and analysis, complete pathway simulation: E-cell.

**Problem Solving in Bioinformatics:** Introduction, Genomic analysis for DNA sequences, Genomic analysis for protein sequences, Strategies and options for similarity search, Practical considerations in sequence analysis, Flowchart for protein structure prediction, Illustrations.

#### **Text Book:**

BIOINFORMATICS Concepts, Skills and applications – S. C. Rastogi, Namita Mendiratta, Parag Rastogi CBS- Publishers and distributors. ISBN- 81-239-0885-7

#### **Reference Books:**

1. Bioinformatics-Databases and Algorithms, by N.Gautham, Narosa Publication ISBN: 81-7319-715-6
2. Bioinformatics – Methods and Applications, by S.C. Rastogi, N. Mendiratta and P. Rastogi, 3rd Edition, PHI. ISBN: 978-81-203-3595-0
3. Bioinformatics- A Beginner's Guide, by Jean-Michel Claveriw, CerdricNotredame WILEY dreamlech India Pvt. Ltd ISBN: 8126503807
4. Introduction to Bioinformatics, by Arthur M. Lesk, OXFORD publishers (Indian Edition) ISBN: 0199580790
5. Introduction to Bioinformatics, by T K Attwood & D J Parry-Smith Addison Wesley Longman ISBN: 8177586416