Deccan Education Society's

FERGUSSON COLLEGE, PUNE
(AUTONOMOUS)

SYLLABUS UNDER AUTONOMY

THIRD YEAR B.Sc. (COMPUTER SCIENCE)

SEMESTER –V

SYLLABUS FOR T.Y. B.Sc. (COMPUTER SCIENCE)
Academic Year 2018-2019

Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS), PUNE 411004
Scheme of Course Structure (Faculty of Science)
2018-2019
T. Y. B. Sc. - Computer Science

Semester	Course Code	Title	Paper No.	Credits	Exam (I / E)	Marks (50 / 50)
V	CSC3501	Operating System Concepts - I	I	3	I / E	50 + 50
	CSC3502	Java Programming - I	II	3	I / E	50 + 50
	CSC3503	Project Development - I	III	3	I / E	50 + 50
	CSC3504	Design and Analysis of Algorithms - I	IV	3	I / E	50 + 50
	CSC3505	Advanced Database Management Concepts **OR**	V	3	I / E	50 + 50
	CSC3506	Data Analytics - I		3	I / E	
	CSC3507	Theoretical Computer Science **OR**	VI	3	I / E	50 + 50
	CSC3508	Computer Networks		3	I / E	
	CSC3511	Computer Science Practical - I	Practical - I	2	I / E	50 + 50
	CSC3512	Computer Science Practical - II	Practical - II	2	I / E	50 + 50
	CSC3513	Computer Science Project - I	Project - I	2	I / E	50 + 50
VI	CSC3601	Operating System Concepts - II	I	3	I / E	50 + 50
	CSC3602	Java Programming - II	II	3	I / E	50 + 50
	CSC3603	Project Development - II	III	3	I / E	50 + 50
	CSC3604	Design and Analysis of Algorithms - II	IV	3	I / E	50 + 50
	CSC3605	Computer Graphics **OR**	V	3	I / E	50 + 50
	CSC3606	Data Analytics - II		3	I / E	50 + 50
	CSC3607	Artificial Intelligence **OR**	VI	3	I / E	50 + 50
	CSC3608	e-Commerce		3	I / E	50 + 50
	CSC3611	Computer Science Practical - III	Practical - III	2	I / E	50 + 50
	CSC3612	Computer Science Practical - IV	Practical - IV	2	I / E	50 + 50
	CSC3613	Computer Science Project - II	Project - II	2	I / E	50 + 50

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – V
COMPUTER SCIENCE PAPER – I
Title: Operating System Concepts – I
PAPER CODE: CSC3501

[Credits - 3]

Learning Objectives
1. To learn and understand fundamentals of system programs.
2. To learn how to design and develop various system software programs such as Editors, Assembler, Macro preprocessor, Linkers and Loaders.

	Title and Contents	**No. of Lectures**
Unit - I	**Introduction** 1.1 Types of program - System program and Application program 1.2 Difference between system programming and application programming 1.3 Elements of programming environment - Editor, Preprocessor, Assembler, Compiler, Interpreter, Linker and Loader, Debugger, Device drivers, Operating System	3
Unit - II	**Assembler** 2.1 Elements of Assembly Language Programming 2.2 Simulation of simple computer smaco (hypothetical computer) -Memory, Registers, Condition Codes, Instruction format, Instruction Set, smaco program 2.3 smaco programs- Translation and Execution 2.4 A simple Assembly scheme 2.5 Pass structure of Assemblers 2.6 Design of Two-pass Assembler	10
Unit -III	**Macros and Macro Pre-processors** 3.1 Concept of Macro 3.2 Macro definition and call 3.3 Macro expansion - positional and keyword parameters 3.4 Design of data structures to be used for Macro definition and use 3.5 Nested macro calls 3.6 Design of macro preprocessor – Design overview, data structure, processing of macro definition and macro expansion	7
Unit - IV	**Linker and Loader** 4.1 Introduction 4.2 Concept of binding - static and dynamic 4.3 Concept of addresses - translated, linked and load time addresses 4.4 Relocation and linking concept – program relocation, performing relocation, public and external references, linking, binary program, object module 4.5 Types of Loaders – compile-and-go, absolute, relocating and direct-linking 4.6 Relocatability - nonrelocatable, relocatable, and self relocating programs 4.7 Linking for Overlays	**7**

Unit - V	**Operating System as System Software**	10
	5.1 What Operating Systems Do – User View, System View, Defining OS	
	5.2 Computer System Architecture – Single processor system, Multiprocessor systems, Clustered Systems	
	5.3 Operating System Operations – Dual mode operation, Privilege Instruction, Timer	
	5.4 Process Management	
	5.5 Memory Management	
	5.6 Storage Management – File system management, Mass storage management, Caching, I/O systems	
	5.7 Protection and Security	
	5.8 Distributed Systems	
	5.9 Special Purpose System – Real time embedded systems, Multimedia systems, Handheld systems,	
	5.10 Computer Environment – Traditional computing, Client server computing, Peer to peer Computing	
	5.11 Operating System Structure – Simple structure, Layered approach, Micro kernels, Modules	
	5.12 Virtual Machines – Introduction, Benefits	
	5.13 System Boot	
Unit - VI	**System Structure**	7
	6.1 Operating System Services	
	6.2 User Operating-System Interface – Command interpreter, GUI	
	6.3 System Calls	
	6.4 Types of System Calls – Process control, File management, Device management, Information maintenance, Communication, Protection	
	6.5 Linux System calls related to file and directory management	
Unit - VII	**Process Concept**	4
	7.1 Process concept- Process, Process State, PCB	
	7.2 Process scheduling	
	7.3 Operations on processes, Linux System calls related to process	
	7.4 Inter-process communication	

References:
1. D. M. Dhamdhere, Systems Programming and Operating Systems, (2nd Revised Edition)
2. Leland L. Beck, System Software - An introduction to Systems Programming, (Pearson Education)
3. John R. Levine, Elsevier Moegan Kaufmann, Linkers and Loaders
4. Silbertchatz, Galvin, Gagne, Operating System Concepts - Willey Publication (8th Edition)
5. John J. Donovan, Systems Programming, McGraw Hill Education

	T. Y. B.Sc. (COMPUTER SCIENCE) Semester – V **COMPUTER SCIENCE PAPER – II** **Title: Java Programming - I** **PAPER CODE: CSC3502**	
		[Credits - 3]

Learning Objectives
1. Understand the strong features of OOPs technology.
2. Design and apply appropriate classes for solving computing problems using OOPs techniques.
3. Understand the application area of Java programming.

	Title and Contents	**No. of Lectures**

Unit - I	**Introduction to Java**
	  1.1 History of Java
	  1.2 Implementation of Object oriented features using Java
	  1.3 Comparison of Java and C++
	  1.4 Java Tools – jdb, javap, javadoc. IDE - Eclipse / NetBeans
	  1.5 Applications of Java
		3

Unit - II	**An Overview of Java**
	  2.1 Simple Java program, Structure of Java program
	  2.2 Array - 1-D,2-D
	  2.3 Accepting input using command line argument
	  2.4. Simple programs using-Conditional Statement(if - else, Switch), Loops(while, do-while, for, for-each)
	  2.4 Array applications - matrix manipulation
		5

Unit - III	**Objects and Classes**
	  3.1 Defining Classes, Access Specifiers (public, protected, private, default)
	  3.2 Array of Objects
	  3.3 Constructor, Overloading Constructors and use of 'this' Keyword
	  3.4 Static block, static Fields and methods
	  3.5 Predefined class – Object class methods (equals(), toString(), hashcode(), getClass())
	  3.6 Inner class
	  3.7 Creating, Accessing and using Packages
	  3.8 Wrapper Classes
	  3.9 Garbage Collection (finalize() Method)
	  3.10 Date and time processing
		7

Unit - IV	**Inheritance and Interface**
	  4.1 Inheritance Basics (extends Keyword) and Types of Inheritance
	  4.2 Superclass, Subclass and use of Super Keyword
	  4.3 Method Overriding and runtime polymorphism
	  4.4 Use of final keyword related to method and class
	  4.5 Use of abstract class and abstract methods
	  4.6 Interfaces-
	        Defining and Implementing Interfaces,
		6

		Runtime polymorphism using interface	
Unit - V	**Exception Handling**		5
	5.1 Dealing Errors		
	5.2 Exception class, Checked and Unchecked exception		
	5.3 Catching exception and exception handling		
	5.4 Creating user defined exceptions		
Unit - VI	**Strings, Streams and Files**		6
	6.1 String class and StringBuffer Class		
	6.2 Using the File class		
	6.3 Stream classes-Byte Stream classes, Character Stream Classes		
	6.4 Creation of files, Reading / Writing characters and bytes, Handling primitive data types		
	6.5 Random Access files		
Unit - VII	**User Interface Components with AWT and Swing**		11
	7.1 What is AWT? What is Swing? Difference between AWT and Swing.		
	7.2 The MVC Architecture and Swing		
	7.3 Layout Manager and Layouts, The JComponent class		
	7.4 Components - JButton, JLabel, JText, JTextArea, JCheckBox and JRadioButton, JList, JComboBox, JMenu and JPopupMenu Class, JMenuItem and JCheckBoxMenuItem, JRadioButtonMenuItem, JScrollBar, JTable		
	7.5 Dialogs (Message, confirmation, input), JFileChooser, JColorChooser		
	7.6 Event Handling: Event sources, Listeners		
	7.7 Mouse and Keyboard Event Handling		
	7.8 Adapters		
	7.9 Anonymous inner class		
Unit - VIII	**Applet**		5
	8.1 Applet Life Cycle		
	8.2 Applet viewer tool		
	8.3 Applet HTML Tags		
	8.4 Passing parameters to Applet		
	8.5 repaint() and update() method		

References:
1. Herbert Schildt, Complete Reference Java (8th edition), Tata McGraw Hill Edition
2. Steven Horlzner, Java 2 Programming Black Book, Dreamtech Press
3. E. Balagurusamy, Programming with Java , A primer, 2nd edition, Tata McGraw Hill Education Private Limited
4. Cay S. Horstmann, Gary Cornell, Core Java Volume-I-Fundamentals, 8th Edition, Prentice Hall, Sun Microsystems Press
5. Cay S. Horstmann, Gary Cornell, Core Java Volume-II Advanced Features, 8th Edition, Prentice Hall, Sun Microsystems Press

[Credits - 3]

Learning Objectives:
1. Understand the basics of System Analysis and Design
2. Understand principles of Software Engineering
3. Understand various Process Models used in practice
4. To know about the System Engineering and Requirement Engineering
5. To build Analysis Model

	Title and Contents	**No. of Lectures**
Unit - I	**System Concepts** 1.1 System Definition 1.2 Elements of a system: Outputs, Inputs, Processor(s), Control, Feedback, Environment, Boundaries, Interface. 1.3 Characteristics of a System : Organization, Subsystem, Interaction, Interdependence, Integration, Central Objective, Standards 1.4 Types of Systems : Physical & Abstract Systems, Open & Closed Systems, Computer-based Systems (MIS: Management Information System & DSS: Decision Support System)	5
Unit - II	**Software and Software Engineering** 2.1 The Nature of Software- Defining Software, Software Application Domains, Legacy Software 2.1 Software Engineering 2.2 Software Process 2.3 Software Engineering Practice- The Essence of Practice, General Principles 2.5 Software Myths	5
Unit - III	**System Development Life Cycle (SDLC)** 3.1 Introduction 3.2 Activities of SDLC- Preliminary Investigation (Request clarification, Feasibility study, Request Approval), Determination of System Requirements, Design of System, Development of Software , System Testing (Unit Testing, Integration testing, System Testing), System Implementation & Evaluation, System Maintenance, Case Study on SDLC 3.3 Process Models- A Generic Process Model, Prescriptive Process Models- The Waterfall Model, Incremental Process Models, Evolutionary Process Models- Prototyping, Spiral Model, Concurrent Models, Introduction to Agile View of Process	12
Unit - IV	**Requirement Engineering** 4.1 Introduction 4.2 Requirements Engineering Tasks-	8

		Inception, Elicitation, Elaboration ,Negotiation, Specification, Validation, Requirements Management
		4.3 Initiating the Requirements Engineering Process-
		    Identifying the Stakeholders,
		    Recognizing Multiple Viewpoints,
		    Working toward Collaboration
		4.4 Fact Finding Techniques-Interview, Questionnaire,
		    Record Review, Observation	

Unit - V	**Structured Analysis Development Strategy**		12

	5.1 Structured Analysis-
	    What is Structured Analysis?
	    Components of Structured analysis,
	    What is Data Flow Analysis?
	5.2 Features and Tools of Data Flow Analysis-
	    Logical Data Flow Diagram (Logical DFD),
	    Notations, Drawing Context Diagram,
	    Case Studies on Context Diagram,
	    Exploring a Context Diagram into greater,
	    detail (1st level, 2nd level DFD, etc.),
	    Evaluating Data Flow Diagram for Correctness,
	    Case Studies on 1st and 2nd Level DFDs.
	5.3 A Data Dictionary-
	    What is a Data Dictionary?
	    Why is a Data Dictionary Important?
	    What is Data Dictionary Record?		

Unit - VI	**Project and Project Management**		6
	6.1 Introduction 6.2 What is Project? 6.3 What is Project Management? 6.4 Project Phases and the Project Life Cycle 6.5 Organizational Structure 6.6 Qualities of the Project Manager 6.7 Project Management Process Groups 6.8 Introduction to Project Management Components 6.9 Reasons of Failure of IT Projects 6.10 Relationships between Project Process Groups, Knowledge Areas and Project Management Processes		

References:
1. Elias M. Awad, System Analysis and Design, Galgotia Publications Pvt. Ltd., 2nd Edition
2. Roger S. Pressman, Software Engineering : A Practitioner's Approach, McGraw Hill International Edition, 7th Edition
3. James A. Senn, Analysis and Design of Information Systems, McGraw Hill International Edition, 2nd Edition
4. S. Parthsarathy, B.W. Khalkar, System Analysis Design & Introduction to Software Engineering, Master Academy ,13th Edition
5. Kathy Schwable, Information Technology Project Management, Cenage Publication, 7th Edition

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – V
COMPUTER SCIENCE PAPER – IV
Title: Design and Analysis of Algorithms – I
PAPER CODE: CSC3504

[Credits – 3]

Learning Objectives:

1. To design the algorithms
2. To select the appropriate algorithm by doing necessary analysis of algorithms

	Title and Contents	No. of Lectures
Unit - I	**Basics of Algorithms** 1.1 Algorithm definition and characteristics 1.2 Space complexity 1.3 Time complexity, worst case-best case-average case 1.4 complexity, asymptotic notation 1.5 Recursion 1.6 Sorting algorithms (insertion sort, heap sort, bubble sort) 1.7 Sorting in linear time: counting sort, concept of bucket and radix sort 1.8 Searching algorithms: Linear, Binary	15
Unit - II	**Divide and conquer strategy** 2.1 General method, control abstraction 2.2 Binary search 2.3 Merge sort, Quick sort	6
Unit - III	**Dynamic Programming** 3.1 Principle of optimality 3.2 Matrix chain multiplication 3.3 Shortest paths: Floyd Warshall, Bellman - ford algorithm Longest common subsequence 3.4 String editing 3.5 0/1 knapsack problem 3.6 Traveling salesperson problem. 3.7 Optimal binary search trees	27

References :
1. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, Computer Algorithms, Galgotia
2. T. Cormen, C. Leiserson, & R. Rivest, Algorithms, MIT Press, 1990
3. A. Aho, J. Hopcroft, & J. Ullman, The Design and Analysis of Computer Algorithms, Addison Wesley, 1974
4. Donald Knuth, The Art of Computer Programming (3 vols., various editions, 1973-81), Addison Wesley
5. Steven Skiena, The Algorithm Manual, Springer ISBN: 9788184898651
6. Jungnickel, Graphs, Networks and Algorithms, Springer, ISBN: 3540219056

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – V
COMPUTER SCIENCE PAPER – V
Title : Advance Database Management Concepts
PAPER CODE: CSC3505

[Credits - 3]

Learning Objectives:
1. To learn and understand advance concepts in DBMS
2. To study various Database Management Systems

	Title and Contents	No. of Lectures
Unit - I	**Overview of storage, Files and Indexing** 1.1 Data on external storage 1.2 File organizations and Indexing 1.3 Index data structures 1.4 Comparison of file organizations 1.5 Indexes and performance tuning memory hierarchy 1.6 RAID 1.7 Tree structured indexing - B+ tree in practice	8
Unit - II	**Introduction to Different databases** 2.1 Significance of Databases 2.2 Comparative study of DBMS, RDBMS, Distributed and Centralized DB	2
Unit - III	**Object and Object Relational Databases** 3.1 Object and Object Relational Databases 3.2 Concepts for Object Databases 3.3 Object Identity, Object structure 3.4 Type Constructors 3.5 Encapsulation of Operations 3.6 Methods 3.7 Type and Class Hierarchies 3.8 Inheritance 3.9 Complex Objects	10
Unit - IV	**Parallel Databases** 4.1 Introduction to Database System Architectures: Centralized, and Client-Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems 4.2 Parallel Databases: I/O Parallelism, Inter and Intra Query Parallelism, Inter and Intra operation Parallelism 4.3 Design of Parallel Systems	6
Unit - V	**Distributed Databases** 5.1 Distributed Database Concepts 5.2 Distributed Data Storage 5.3 Distributed Transactions 5.4 Commit Protocols 5.5 Concurrency Control 5.6 Distributed Query Processing	7
Unit - VI	**Spatial Databases** 6.1 Introduction 6.2 Spatial Data Types 6.3 Spatial Relationships	5

	6.4 Spatial Data Structures	
	6.5 Spatial Access Methods	
Unit - VII	**Advanced Data Models**	10
	7.1 Mobile Databases:	
	7.2 Location and Handoff Management	
	7.3 Effect of Mobility on Data Management	
	7.4 Location Dependent Data Distribution	
	7.5 Mobile Transaction Models	
	7.6 Concurrency Control	
	7.7 Transaction Commit Protocols	
	7.8 Multimedia Databases	
	7.9 Information Retrieval	
	7.10 Data Warehousing	
	7.11 Data Mining	
	7.12 Text Mining	

References:
1. Shio Kumar Singh, Database Systems: Concepts, Design and Applications, 2nd Edition, Pearson Education
2. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, TATA McGraw Hill 3rd Edition
3. Silberschatz, Korth, Database System Concepts, McGraw hill, 5th Edition
4. Elmasri, Navathe, Fundamentals of Database Systems, Pearson Education

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – V
COMPUTER SCIENCE PAPER – VI
Title: Data Analytics - I
PAPER CODE: CSC3506

[Credits - 3]

Learning objectives:
1. To understand the various representation of the data using R programming.
2. To make the students familiar with scope of data analytics.
3. Students will be aware of implementing tools and techniques in machine learning.
4. Skills in scripting for data manipulation, analysis, and visualization using R, R-Studio, and a variety of add on packages

	Title and Contents	**No. of Lectures**
Unit - I	**Introduction to Data Analytics** 1.1 Essentials of Data and data analysis 1.2 Framework of data analytics 1.3 Data-driven decision making	4
Unit - II	**R Programming** 2.1 Introduction 2.2 Basic data types 2.3 Control Structure 2.4 Matrices and Vectors 2.5 Lists Functions 2.6 Data frames 2.7 Import & Export of files in R 2.8 Building R Packages, Running and Manipulating Packages	10
Unit - III	**Data Visualization** 3.1 Charts and exploratory graphs 3.2 Relationship plots 3.3 Use of R package for data visualisation	8
Unit - IV	**Data Preprocessing** 4.1 Need of Data Preprocessing 4.2 Data Cleaning 4.3 Data Integration & Transformation	8
Unit - V	**Basics of Statistics using R** 5.1 Basics: mean, median, standard deviation, variance, correlation, covariance 5.2 Linear regression: Simple linear regression, Multiple regression 5.3 PCA basics, covariance / correlation matrix	8
Unit - VI	**Introduction to Machine Learning** 6.1 Basics / Challenges in Machine Learning 6.2 Techniques: Classification, Clustering, Prediction 6.3 Prediction Model 6.4 Machine Learning Algorithms: Supervised & unsupervised algorithms 6.5 Performance Measures 6.6 Working with Data Sets	10
References:		

1. Nina Zumel, John Mount Practical Data Science with R, Dreamtech press
2. S. K. Shinde Uddagiri Chandrasekhar, Data Mining and Business Intelligence dreamtech press
3. Ronald E Walpole, Sharon L Myres, Keying Ye, Probability and Statistics for Engineers and Scientist, 8th Edition, Pearson
4. George W Snedecor, William G. Cochran, Statistical Methods, Eighth Edition
5. C R Kothari, Quantitative Techniques, 3rd revised Edition
6. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, 3rd Edition
7. Margaret H. Dunham, S. Sridhar, Data Mining - Introductory and Advanced Topics, Pearson Education
8. Tom Mitchell, Machine Learning, McGraw-Hill, 1997
9. R. O. Duda, P. E. Hart, D. G. Stork, Pattern Classification, 2nd edition. John Wiley and Sons, 2000.
10. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer 2006. Ian H. Witten, Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Elsevier / (Morgan Kauffman)

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – V
COMPUTER SCIENCE PAPER – VII
Title: Theoretical Computer Science
PAPER CODE:CSC3507

[Credits - 3]

Learning Objectives:
1.   To have an understanding of finite state and pushdown automata.
2.   To have a knowledge of regular languages and context free languages.
3.   To know the relation between regular language, context free language and corresponding recognizers.
4.   To study the Turing machine and classes of problems.

	Title and Contents	**No. of Lectures**
Unit - I	**Introduction**	3
	1.1 Symbol, Alphabet, String, Prefix & Suffix of Strings, Formal Language, Operations on Languages.	
	1.2 Regular Expressions (RE): Definition & Examples Regular Expression: Identities.	
Unit - II	**Finite Automata**	17
	2.1 Finite automata: Concept, transition function, transition diagram	
	2.2 Deterministic finite Automaton - Definition,	
	2.3 Nondeterministic finite automaton - Definition and Examples.	
	2.4 NFA to DFA: Method (From Book 4) and Problems	
	2.5 NFA with ε-transitions Definition and Examples.	
	2.6 NFA with ε-Transitions to DFA: Examples	
	2.7 Finite automaton with output - Mealy and Moore machine, Definition and Examples, Equivalence.	
	2.8 Minimization of DFA, Algorithm & Problem using Table Method.	
	2.9 DFA as language recognizer, DFA as a pattern recognizer. Application: token recognizers in Lexical Analysis phase of compiler construction and Lexical Analyzer: LEX Example	
Unit - III	**Regular Languages**	5
	3.1 Regular language - Definition and Examples.	
	3.2 Conversion of RE to FA - Examples.	
	3.3 Pumping lemma for regular languages & Applications.	
	3.4 Closure properties of regular Languages (Union, Concatenation, Kleene closure, Complement and Intersection)	
Unit - IV	**Context Free Grammar and Languages**	13
	4.1 Grammar - Definition and Examples.	
	4.2 Derivation-Reduction - Definition and Examples.	
	4.3 Chomsky Hierarchy.	
	4.4 CFG: Definition & Examples. Left Most derivation,	

	Right Most Derivation, Parse Tree	
	4.5 Ambiguous Grammar: Concept & Examples.	
	4.6 Simplification of CFG :Removing Useless Symbols, Removing unit productions, Removing ϵ productions & Nullable symbol	
	4.7 Normal Forms: Chomsky Normal Form (CNF) Method and Examples, Greibach Normal Form (GNF) Method and Examples	
	4.8 Regular Grammar: Definition- Left linear and Right Linear Grammar: Definition and Example, Equivalence of FA & Regular Grammar, Construction of regular grammar equivalent to a given DFA, Construction of a FA from the given right linear grammar,	
	4.9 Closure Properties of CFL's (Union, concatenation and Kleene closure) Method and examples	
	4.10 Application: To specify and implement the (Parsers) Syntax Analysis phase of Compiler Construction	
	4.11 Parser generator: YACC demo	
Unit - V	**Push Down Automaton**	5
	5.1 Definition of PDA and Example	
	5.2 Language acceptance by empty stack and by final state.	
	5.3 Construction of PDA using empty stack Method and Examples	
	5.4 Definition DPDA & NPDA	
	5.5 Examples of NPDA	
	5.6 Construction of PDA from the given CFG: Method and Examples	
Unit - VI	**Turing Machine**	5
	6.1 The Turing Machine Model and Definition of TM	
	6.2 Design of Turing Machines	
	6.3 Language accepted by TM	
	6.4 Types of Turing Machines (Multitrack TM, Two way TM, Multitape TM, Non-deterministic TM)	
	6.5 Composite TM, Enumerating TM, Universal TM	
	6.6 Recursive Languages 6.6.1 Recursive and Recursively enumerable Languages.	

References:
1. John E. Hopcroft and Jeffrey Ullman - Narosa Publishing House, Introduction to Automata theory, Languages and computation
2. John Hopcroft, Rajeev Motwani and Jeffrey Ullman, Introduction to Automata theory, Languages and computation, 3rd edition Pearson Education
3. Daniel I. A. Cohen ,John Wiley & Sons, Introduction to Computer Theory, 2nd edition
4. K. L. P. Mishra & N. Chandrasekaran, PHI Second Edition, Theory of Computer Science , (Automata, Language & Computation)
5. John C. Martin TMH, Introduction to Languages and The Theory of Computation, 2nd Edition Published by John Wiley & Sons, Inc.

[Credits - 3]

Learning objectives:

1. Understanding Basic networking concepts.
2. Understanding different types of networks, topologies and application of networks.
3. Understanding data communications and types of addresses.
4. Understanding different network models, protocols, functionality of each layer.

	Title and Contents	**No. of Lectures**
Unit - I	**Introduction to Computer Networks** 1.1 Computer Networks - Goals and applications - Business Application, Home Application, Mobile User, Social Issues 1.2 Network Hardware - Broadcast and point-to-point 1.3 Data Communication - Definition, components, data representation, Data Flow 1.4 Topologies - bus, ring, star, mesh, and hybrid 1.5 Network Types - LAN, MAN, WAN, Wireless Networks, Home Networks, Internetwork 1.6 Protocols & Standards De facto and De jure standard 1.7 Network Software - Protocol Hierarchies -layers, protocols, peers, interfaces 1.8 Network architecture, Definition of protocol stack, Design issues of the layers - addressing, error control, flow control, multiplexing and demultiplexing, routing, Connection-oriented and connectionless services 1.9 Network Models- OSI Reference Model with functionalities of each layer, TCP/IP Reference Model with functionality of each layer, Protocol suit, Comparison of OSI and TCP/IP model 1.10 Addressing - Physical, Logical and Port addresses	14
Unit - II	**The Physical Layer** 2.1 Line Coding, Line Coding Characteristics, Line Coding Schemes - Unipolar - NRZ, Polar-NRZ-I, NRZ-L, RZ, Manchester and Differential Manchester (Enough problems should be covered on every topic.) 2.2 Switching - Circuit Switching, Message Switching and Packet Switching, comparison of circuit & packet switching	4
Unit - III	**The Data Link Layer** 3.1 Design Issues - Services to Network Layer, Flow Control, Error Control Framing - Character Count, Flag bytes with Byte Stuffing, starting & ending Flags with Bit Stuffing and Physical Layer Coding Violations	10

	3.2	Error detection code CRC (Enough problems should be covered)	
	3.3	Data Link Layer Protocols - Noiseless channel - A Simplex, Stop-And-Wait protocol, noisy channel - stop & wait, ARR, Pipelining, Go-back-N ARR & ARQ, selective repeat ARR	
	3.4	Sliding Window Protocols Piggybacking - Need, Advantages / Disadvantages, 1-bit sliding window protocols	
	3.5	Data Link Layer Protocols - HDLC - frame format, all frame types PPP - Use, Frame Format, Use of PPP in the Internet	
Unit - IV	**The Medium Access Sublayer**		6
	4.1	Random Access Protocols ALOHA - pure and slotted	
	4.2	CSMA - 1-persistent, p-persistent and non-persistent CSMA / CD, CSMA / CA	
	4.3	Controlled Access Reservation, Polling and Token Passing	
	4.4	Channelization FDMA, TDMA and CDMA - Analogy, Idea, Chips, Data Representation, Encoding and Decoding, Signal Level, Sequence Generation (Enough problems should be covered on CDMA)	
Unit - V	**The Network Layer**		10
	5.1	Design Issues Store-and-forward packet switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram	
	5.2	Logical Addressing IPV4 Addresses - Address Space, Notations, Classful Addressing, Classless Addressing, Network Address Translation (Problems on Addressing)	
	5.3	IPV4 Protocol - Datagram, Fragmentation, Checksum calculation, Options	
	5.4	Routing - Properties of routing algorithm, Types, Comparison of Adaptive and Non-Adaptive Routing Algorithms	
	5.5	Congestion Control General Principles of Congestion Control Congestion Prevention Policies	
Unit - VI	**Wired and Wireless LAN**		4
	6.1	Concept	
	6.2	Virtual LANs Membership, Configuration, Communication between Switches, Advantages	
	6.3	IEEE 802.11 Architecture - Basic Service Set, Extended Service Set, Station Types	
	6.4	Bluetooth Architecture - Piconet, scatternet	

References:

1. Andrew Tanenbaum, Computer Networks, Pearson Education. [4th Edition]
2. Behrouz Forouzan, Data Communication and Networking, Tata McGraw Hill. [4th Edition]

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – V
Title: Computer Science Practical - I
PAPER CODE: CSC3511

[Credits - 2]

Sr. No.	Title of Experiment / Practical
1	Assembler - 1
2	Assembler - 2
3	Assembler - 3
4	Assembler - 4
5	Simulator - 1
6	Simulator – 2
7	Macro Preprocessor
8	Handling Shell - 1
9	Handling Shell - 2
10	Handling Shell - 3

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – V
Title: Computer Science Practical - II
PAPER CODE: CSC3512

[Credits - 2]

Sr. No.	Title of Experiment / Practical
1	Introduction to Java
2	Objects and Classes
3	Inheritance and Interface
4	Exception Handling
5	Strings, Streams and Files
6	GUI Designing with Event Handling
7	Applets
8	More on Packages
9	More on Swings
10	More on Applets

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – V
Title: Computer Science Project - I
PAPER CODE: CSC3513

[Credits - 2]

Sr. No.	Title of Experiment / Practical
1	Problem Definition and Feasibility Study
2	Gathering Data Requirements and Functional Requirements
3	Entity Relationship Diagram, Designing the normalized Database
4	UML Diagrams
5	I/O screens
6	Test Case Design
7	Coding and Implementation
8	Coding and Implementation
9	Coding, Testing and Debugging
10	Documentation
11	Final Demo

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SYLLABUS UNDER AUTONOMY

THIRD YEAR B.Sc. (COMPUTER SCIENCE)

SEMESTER – VI

SYLLABUS FOR T.Y. B.Sc. (COMPUTER SCIENCE)
Academic Year 2018-2019

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI
COMPUTER SCIENCE PAPER – I
Title: Operating System Concepts - II
PAPER CODE: CSC3601

[Credits - 3]

Learning objectives:
1. To understand basic concepts and functions of modern operating systems.
2. To understand the concept of process, and thread with scheduling, process synchronization and deadlock.
3. To know the concept of I/O and File management, various Memory management techniques and related algorithms.

	Title and Contents	No. of Lectures
Unit - I	**Process Scheduling** 1.1 Basic Concept - CPU-I/O burst cycle, CPU scheduler, Preemptive scheduling, Dispatcher 1.2 Scheduling Criteria 1.3 Scheduling Algorithms - FCFS, SJF, Priority scheduling, Round-robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling	8
Unit - II	**Deadlocks** 2.1 System model 2.2 Deadlock Characterization - Necessary conditions, Resource allocation graph 2.3 Deadlock Prevention 2.4 Deadlock Avoidance - Safe state, Resource allocation graph algorithm, Banker's Algorithm 2.5 Deadlock Detection 2.6 Recovery from Deadlock - Process termination, Resource preemption	8
Unit - III	**Process Synchronization** 3.1 Background 3.2 Critical Section Problem 3.3 Semaphores: Usage, Implementation	3
Unit - IV	**Memory Management** 4.1 Background - Basic hardware, Address binding, Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries 4.2 Swapping 4.3 Contiguous Memory Allocation - Memory mapping and protection, Memory allocation, Fragmentation 4.4 Paging - Basic method, Hardware support, Protection, Shared Pages 4.5 Segmentation - Basic concept, Hardware 4.6 Virtual Memory Management - Background, Demand paging, Performance of demand paging, Page replacement - FIFO, OPT, LRU, Second chance page replacement	10
Unit - V	**File System** 5.1 File concept 5.2 Access Methods - Sequential, Direct, Other	6

	access methods	
	5.3 Directory and Disk Structure – Storage structure, Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory	
	5.4 Allocation Methods - Contiguous allocation, Linked allocation, Indexed allocation	
	5.5 Free Space Management - Bit vector, Linked list	
Unit - VI	**Disk System**	4
	6.1 Overview	
	6.2 Disk Structure	
	6.3 Disk Scheduling and Disk Scheduling Algorithms	
Unit - VII	**Case Studies**	9
	7.1 Linux System-Design Principles, Kernel Modules , File System - ext3, journaling feature	
	7.2 Windows 7-Design Principles, File System- FAT and NTFS	
	7.3 Android System-Overview, Environment Setup, Architecture, Application Components, Android activity and services Lifecycle	
	7.4 Object file formats-a.out, ELF, COFF, EXE, COM,PE	

References:
1. Siberchatz, Galvin, Gagne, Operating System Concepts - Willey Publication (8th Edition).
2. Pabitra Pal Choudhary, Operating Systems: Principles and Design - (PHI Learning Pvt. Ltd.)
3. Rick Rogers, John Lombardo, Zigurd Mednieks & Blake Meike, Android Application Development, O'Reilly
4. https://pdfs.semanticscholar.org/6a01/2a232faa0b885e8c45a1775d16ddc02b5680.pdf
5. https://www.tutorialspoint.com/android/index.htm

	T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI COMPUTER SCIENCE PAPER – II Title: Java Programming - II PAPER CODE:CSC3602	
		[Credits - 3]
Learning objectives: 1. Understand the strong features of Java technology. 2. Design and apply appropriate classes for solving computing problems using Java techniques in the area of database, networking and client-server programming. 3. Understand the application area of Java programming.		
	Title and Contents	**No. of Lectures**
Unit - I	**Collection** 1.1 Introduction to the Collection framework 1.2 List - ArrayList, LinkedList and Vector, Stack, Queue 1.3 Set - HashSet, TreeSet, and LinkedHashSet 1.4 Map - HashMap, LinkedHashMap, Hashtable and TreeMap 1.5 Interfaces such as Comparator, Iterator, ListIterator	5
Unit - II	**Multithreading** 2.1 What are threads? 2.2 Life cycle of a thread 2.3 Running and starting thread using Thread class 2.4 Thread priorities 2.5 Running multiple threads 2.6 The Runnable interface 2.7 Synchronization and interthread communication	6
Unit - III	**Database Programming** 3.1 The design of jdbc, jdbc configuration 3.2 Types of drivers 3.3 Executing sql statements, query execution 3.4 Scrollable and updatable result sets 3.5 Metadata - DatabaseMetadata, ResultSetMetadata 3.6 Transactions - commit(), rollback(), SavePoint (Database: PostgreSQL)	9
Unit - IV	**Servlet** 4.1 Introduction to Servlet and Hierarchy of Servlet 4.2 Life cycle of Servlet 4.3 Tomcat- Introduction and Configuration 4.4 Handling get and post request (HTTP) 4.5 Handling a data from HTML to Servlet 4.6 Retrieving a data from database to Servlet 4.7 Session tracking - User Authorization, URL Rewriting, Hidden form fields, Cookies, HttpSession	10
Unit - V	**JSP** 5.1 Life cycle of JSP 5.2 Implicit Objects 5.3 Scripting elements - Declarations, Expressions,	13

	5.4 Scriptlets, Comments 5.5 Simple JSP program 5.6 JSP Directives - Page directive, include directive 5.7 Mixing Scriptlets and HTML 5.8 Example of forwarding contents from database to servlet, servlet to JSP and displaying it using JSP scriptlet tag 5.9 User Defined Functions in JSP 5.10 Expression Language - What is EL? EL Syntax, Operators 5.11 Web designing using JSP- Sample application (JSP - JDBC), Designing different database oriented portals	
Unit - VI	**Networking** 6.1 Networking basics - Protocol, Addressing, DNS, URL, Socket, Port 6.2 The java.net package - InetAddress, URL, URL Connection class 6.3 SocketServer and Socket class 6.4 Creating a Socket to a remote host on a port (creating TCP client and server) 6.5 Simple Socket Program Examples	5

References:
1. Herbert Schildt, Complete reference Java, 8th Edition, Tata McGraw Hill Edition
2. Steven Horlzner, Java 2 programming Black Book, Dreamtech Press
3. E. Balagurusamy, Programming with Java-A primer, second edition, Tata Mcgraw Hill Education Private Limited
4. Cay S. Horstmann, Gary Cornell, Core Java Volume-I-Fundamentals, 8th Edition, Prentice Hall, Sun Microsystems Press
5. Cay S. Horstmann, Gary Cornell, Core Java Volume-II Advanced Features, 8th Edition, Prentice Hall, Sun Microsystems Press
6. Bryan Basham, Kathy Sierra and Bert Bates, The Brain Friendly study Guide Head First Servlets and JSP, 1st Edition, O'Reilly Publications

[Credits - 3]

Learning Objectives:
1. To understand the components of Unified Modeling Language
2. To understand techniques and diagrams related to structural modeling
3. To understand techniques and diagrams related to behavioral modeling
4. To understand techniques of Object Oriented analysis, design and testing

	Title and Contents	**No. of Lectures**
Unit - I	**Object Oriented Concepts and Principles**	4
	1.1 What is Object Orientation? - Introduction, Object, Classes and Instance, Polymorphism, Inheritance	
	1.2 Object Oriented System Development - Introduction, Function / Data Methods (With Visibility), Object Oriented Analysis, Object Oriented Construction	
	1.3 Identifying the Elements of an Object Model	
	1.4 Identifying Classes and Objects	
	1.5 Specifying the Attributes (With Visibility)	
	1.6 Defining Operations	
	1.7 Finalizing the Object Definition	
Unit - II	**Introduction to UML And Basic Use Case Diagram**	5
	2.1 Concept of UML	
	2.2 Advantages of UML	
	2.3 Actors - Types of actors notations	
	2.4 Use Cases and Use Case Diagram with stereo types (Minimum three examples should be covered)	
Unit - III	**Basic Structural Modeling**	5
	3.1 Classes	
	3.2 Relationship	
	3.3 Common Mechanism	
	3.4 Class Diagram (Minimum three examples should be covered)	
	3.5 Object Diagram (Minimum three examples should be covered)	
Unit - IV	**Advanced Structural Modeling**	7
	4.1 Advanced Classes	
	4.2 Advanced Relationship	
	4.3 Interface	
	4.4 Types and Roles	
	4.5 Packages	
Unit - V	**Basic Behavioral Modeling**	6
	5.1 Interactions	
	5.2 Interaction Diagram (Minimum two examples should be covered)	
	5.3 Sequence Diagram (Minimum two examples should be covered)	
	5.4 Activity Diagram (Minimum two examples should be covered)	
	5.5 Collaboration Diagram (Minimum two examples	

	should be covered)	
	5.6 State Chart Diagram (Minimum two examples should be covered)	
Unit - VI	**Architectural modeling** 6.1 Component 6.2 Components Diagram (Minimum two examples should be covered) 6.3 Deployment Diagram (Minimum two examples should be covered)	6
Unit - VII	**Object Oriented Testing** 7.1 Object Oriented Testing Strategies 7.2 Test Case Design for Object Oriented Software 7.3 Inter Class Test Case Design	5
Unit - VIII	**Object Oriented Analysis** 8.1 Iterative Development and the Rational Unified Process 8.2 Inception 8.3 Understanding Requirements 8.4 Use Case Model From Inception to Elaboration 8.5 Elaboration	6
Unit - IX	**Object Oriented Design** 9.1 The Booch Method, The Coad and Yourdon Method and Jacobson Method and Raumbaugh Method 9.2 The Generic Components of the OO Design Model 9.3 The System Design Process - Partitioning the Analysis Model, Concurrency and Sub System Allocation, Task Management Component, The Data Management Component, The Resource Management Component, Inter Sub System Communication 9.4 Object Design Process	4

References:
1. Grady Booch, James Rambaugh, The Unified Modeling Language User / Reference Guide, Pearson Education INC
2. Ivar Jacobson, Object Oriented Software Engineering, Pearson Education INC
3. Craig Larman, Applying UML and Patterns, Pearson Education INC
4. Bennett, Simon, Object Oriented Analysis and Design, McGraw Hill

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI
COMPUTER SCIENCE PAPER – IV
Title: Design and Analysis of Algorithms - II
PAPER CODE:CSC3604

[Credits - 3]

Learning objectives:
1. To design the algorithms
2. To select the appropriate algorithm by doing necessary analysis of algorithms

	Title and Contents	No. of Lectures
Unit - I	**Greedy Method** 1.1 Control Abstraction 1.2 0-1 knapsack problem 1.3 Job sequencing with deadlines, 1.4 Minimum-cost spanning trees: Kruskal and Prim's algorithm 1.5 Optimal storage on tapes 1.6 Optimal merge patterns 1.7 Huffman coding 1.8 Shortest Path: Dijkstra's algorithm	14
Unit - II	**Decrease and Conquer**: 2.1 DFS and BFS 2.2 Topological sorting 2.3 Connected components and spanning trees 2.4 Euclid's algorithm 2.5 Flow in graph	12
Unit - III	**Backtracking** 3.1 General method 3.2 n- Queen's problem 3.3 Graph coloring problem 3.4 Hamiltonian cycle 3.5 Sum of subsets	10
Unit - IV	**Branch and Bound** 4.1 Concept 4.2 LIFO, FIFO and LCBB 4.3 Travelling salesman problem	8
Unit - V	**Problem Classification** 5.1 Nondeterministic algorithm 5.2 The class of P, NP, NP-hard and NP - Complete problems 5.3 Cook's theorem	4

References:
1. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, Computer Algorithms, Galgotia
2. T. Cormen, C. Leiserson, & R. Rivest, Algorithms, MIT Press, 1990
3. A. Aho, J. Hopcroft & J. Ullman, The Design and Analysis of Computer Algorithms,
4. Addison Wesley, 1974
5. Donald Knuth, The Art of Computer Programming (3 vols., various editions, 1973-81), Addison Wesley
6. Steven Skiena, The Algorithm Manual, Springer ISBN:9788184898651
7. Jungnickel, Graphs, Networks and Algorithms, Springer, ISBN: 3540219056

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI
COMPUTER SCIENCE PAPER – V
Title: Computer Graphics
PAPER CODE: CSC3605

[Credits - 3]

Learning Objectives:
1. To study how graphics objects are represented in Computer.
2. To study how graphics system in a computer supports presentation of graphics information
3. To study how to manipulate graphics object by applying different transformations
4. To provide the programmer's perspective of working of computer graphics
5. To study how interaction is handled in a graphics system

	Title and Contents	No. of Lectures
Unit - I	**Introduction to Computer graphics** 1.1 Introduction to computer graphics & graphics systems. 1.2 Components of Computer Graphics Representation, Presentation, Interaction and Transformations. 1.3 Applications of Computer Graphics. 1.4 Pixel / Point, Raster v/s Vector, RGB color model, intensity. 1.5 Programming essentials - event driven programming, OpenGL library.	4
Unit - II	**Input devices and Interaction tasks** 2.1 Logical Interaction - Locator, valuator, pick and choice. 2.2 Physical devices used for interaction - keyboard, mouse, trackball, spaceball, tablets, light pen, joy stick, touch panel, data glove. 2.3 Keyboard, Mouse interaction in OpenGL. 2.4 Graphical User Interfaces- cursors, radio buttons, scroll bars, menus, icons. 2.5 Implementing GUI in open GL.	6
Unit - III	**Presentation and Output devices** 3.1 Presentation Graphics - frame buffer, display file, lookup table. 3.2 Display devices, Random and Raster scan display devices, CRT. 3.3 Hardcopy devices - Plotters and Printers.	4
Unit - IV	**Raster Scan Graphics** 4.1 Line drawing algorithms; DDA algorithm, Bresenham's line drawing algorithm, Circle generation algorithm. 4.2 Scan conversions- Generation of the Display, Image compression. 4.3 Displaying Lines and characters. 4.4 Polygon filling -Scan converting polygons, fill algorithms, Boundary fill algorithm, flood fill algorithm.	14
Unit - V	**Clipping** 5.1 Clipping operations, point clipping. 5.2 Line clipping; Cohen Sutherland algorithm, Midpoint	7

		subdivision algorithm, Cyrus beck algorithm. 5.3 Polygon clipping, Sutherland Hodgman algorithm, Weiler-Atherton Algorithm.	
Unit - VI	**Transformations** 6.1 Basic transformations: translation, rotation, scaling, Matrix representations & homogeneous coordinates, Reflection, shear. 6.2 Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline. 6.3 Window to viewport co-ordinate transformation. Setting window and viewport in OpenGL.	7
Unit - VII	**3D transformation & viewing** 7.1 Basic 3D transformations: translation, rotation, scaling & other transformations. 7.2 Three dimensional viewing, Parallel and Perspective projections. 7.3 View Volumes and General Projection Transformations. 7.4 3D clipping	6

References:

1. Hearn, Baker, Computer Graphics, Pearson Education, (C version 2nd Ed.)
2. F. S. Hill, Stephen Kelly, Computer Graphics using OpenGL, PHI Learning
3. David F. Rogers, Procedural Elements of Computer Graphics, Tata McGraw Hill
4. Foley, Vandam, Feiner, Hughes, Computer Graphics principles, Pearson Education, (2nd Ed.)
5. W. M. Newman, R. F. Sproull, Principles of Interactive Computer Graphics, Tata McGraw Hill
6. D. F. Rogers, J. A. Adams, Mathematical Elements for Computer Graphics, Tata McGraw Hill, (2nd Ed.)
7. Z. Xiang, R. Plastock, Schaum's outlines Computer Graphics, Tata McGraw Hill, (2nd Ed.)

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI
COMPUTER SCIENCE PAPER – VI
Title: Data Analytics - II
PAPER CODE: CSC3606

[Credits - 3]

Learning objectives:
1. To understand the various representation of the data using R programming.
2. To make the students familiar with scope of data analytics.
3. Students will be aware of implementing tools and techniques in machine learning.
4. Skills in scripting for data manipulation, analysis, and visualization using R, R-Studio and a variety of add on packages.

	Title and Contents	No. of Lectures
Unit - I	**Machine learning Model Building** 1.1 Mapping problems to machine learning tasks 1.2 Building and Evaluation of a Model 1.3 Validation of Model.	4
Unit - II	**Linear and Logistic Regression** 2.1 Understanding linear regression: building a linear regression model, making predictions. 2.2 Using logistic regression: Building logistic regression model, making predictions. 2.3 Bias - Variance Dichotomy 2.4 Model Validation Approaches 2.5 Linear Discriminant Analysis 2.6 Quadratic Discriminant Analysis	5
Unit - III	**Supervised Learning with Regression and Classification Techniques - I** 3.1 KNN: Need, K mean function, selection of K value 3.2 Confusion Matrix Generation 3.3 Introduction to Support Vector Machine: working, tuning of Parameters, handling data sets using support vector machine.	9
Unit - IV	**Supervised Learning with Regression and Classification Techniques - II** 4.1 Decision Trees 4.2 Random Forest 4.3 Naïve Bayes Theorem and its role	7
Unit - V	**Unsupervised Learning** 5.1 Clustering 5.2 K-means clustering 5.3 Hierarchical clustering 5.4 Feature selection 5.5 Anomaly detection 5.6 Associative Rule Mining: Overview, Mining association rule, apriori algorithm	17
Unit - VI	**Introduction to Big Data** 6.1 Scope of Big Data and its sources 6.2 Structured / Unstructured Data 6.3 Challenges in Big data	3
Unit - VII	**Text Analytics: Scope and Challenges**	3

	7.1 Overview of Text Mining	
	7.2 Sentiment analysis	

References:
1. Nina Zumel , John Mount, Practical Data Science with R, Dreamtech press
2. S. K. Shinde Uddagiri Chandrasekhar, Data Mining and Business Intelligence Dreamtech press
3. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, 3rd Edition
4. Margaret H. Dunham, S. Sridhar, Data Mining - Introductory and Advanced Topics, Pearson Education
5. Tom Mitchell, Machine Learning‖, McGraw-Hill, 1997
6. R.O. Duda, P.E. Hart, D.G. Stork., Pattern Classification, Second edition. John Wiley and Sons, 2000.
7. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer 2006
8. Ian H. Witten, Data Mining: Practical Machine Learning Tools and Techniques, Eibe Frank Elsevier / (Morgan Kauffman)

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI
COMPUTER SCIENCE PAPER – VII
Title: Artificial Intelligence
PAPER CODE: CSC3607

[Credits - 3]

Learning objectives:

1. Understanding basic knowledge representation, problem solving and learning methods of Artificial Intelligence

	Title and Contents	No. of Lectures
Unit - I	**Introduction to Artificial Intelligence:** 1.1 Overview and Historical Perspective 1.2 Turing test 1.3 Physical Symbol Systems and the scope of Symbolic AI 1.4 Agents 1.5 Branches of AI 1.6 Applications of AI.	6

Unit - II	**Problem Solving, Search and Control Strategies: State Space Search:**
	2.1 Depth First Search
	2.2 Breadth First Search
	2.3 DFID
	2.4 Heuristic Search:
	     Best First Search, Hill Climbing, Beam Search
	     Tabu Search
	2.5 Randomized Search:
	     Simulated Annealing, Genetic Algorithms,
	     Ant Colony Optimization
	2.6 Finding Optimal Paths:
	     Branch and Bound, 2.6.2 A*, 2.6.3 IDA*
	2.7 Divide and Conquer approaches
	2.8 Beam Stack Search
	2.9 Goal Trees
	2.10 AO*
	2.11 Rule Based Systems
	2.12 Rete Net.
		14

Unit - III	**Knowledge Representations Issues, Predicate Logic, Rules &Reasoning:** 3.1 Knowledge representation 3.2 KR using predicate logic 3.3 KR using rules 3.4 Overview of reasoning 3.5 Symbolic reasoning 3.6 Statistical reasoning 3.7 Control Knowledge 3.8 Expert System	8
Unit –IV	**Game Playing:** 4.1 Minimax Algorithm 4.2 AlphaBeta Algorithm 4.3 SSS*	3

Unit –V	**Planning and Constraint Satisfaction**:	10
	5.1 Domains	
	5.2 Forward and Backward Search	
	5.3 Goal Stack Planning, Plan Space Planning	
	5.4 Graphplan	
	5.5 Constraint Propagation	
Unit –VI	**Logic and Inferences**:	**7**
	6.1 Propositional Logic	
	6.2 First Order Logic	
	6.3 Soundness and Completeness	
	6.4 Forward and Backward chaining	

References:
1. Elaine Rich and Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 2nd Edition
2. Dan Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India

<table>
<tr><td colspan="3" align="center">T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI
COMPUTER SCIENCE PAPER – VIII
Title: e-Commerce
PAPER CODE:CSC3608</td></tr>
<tr><td colspan="3" align="right">[Credits - 3]</td></tr>
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Learning Objectives:
1.   To understand why information technology is so important today for business.
2.   To provide adequate knowledge and understanding about E-Commerce.
3.   To understand the modern technology in Commercial Operations.

	Title and Contents	**No. of Lectures**
Unit - I	**Introduction to e-Commerce** 1.1 The Scope of Electronic Commerce 1.2 Definition of Electronic Commerce 1.3 Electronic Commerce and the Trade Cycle 1.4 Electronic Markets 1.5 Electronic Data Interchange 1.6 Internet Commerce 1.7 e-Commerce in Perspective	6
Unit - II	**Business Strategy in an Electronic Age** 2.1 Supply Chains, Porter's Value Chain Model 2.2 Inter Organizational Value Chains 2.3 Competitive Strategy 2.4 Porter's Model 2.5 First Mover Advantage 2.6 Sustainable Competitive Advantage 2.7 Competitive Advantage using e-Commerce 2.8 Business Strategy	8
Unit - III	**Introduction to Business Strategy** 3.1 Strategic Implications of IT Technology 3.2 Business Environment 3.3 Business Capability 3.4 Existing Business Strategy 3.5 Strategy Formulation & Implementation Planning 3.6 e-Commerce Implementation 3.7 e-Commerce Evaluation	8

Unit - IV	**Business-to-Business Electronic Commerce** 4.1 Characteristics of B2B EC 4.2 Models of B2B EC 4.3 Procurement Management Using the Buyer's Internal Marketplace 4.4 Supplier-Oriented 4.5 Marketplace 4.6 Intermediary-Oriented Marketplace 4.7 Just-inTime Delivery 4.8 Auctions and Services from Traditional to Internet-Based EDI 4.9 Integration with Back-end Information Systems 4.10 The Role of Software Agents for B2B EC 4.11 Electronic Marketing in B2B 4.12 Solutions of B2B EC 4.13 Managerial Issues 4.14 Electronic Data Interchange (EDI)	14
Unit - V	**Electronic Payment Systems** 5.1 Is SET a Failure, Electronic Payments & Protocols 5.2 Security Schemes in Electronic Payment Systems 5.3 Electronic Credit Card System on the Internet 5.4 Electronic Fund Transfer and Debit Cards on the Internet 5.5 Stored-Valued Cards and E-Cash 5.6 Electronic Check Systems 5.7 Prospect of Electronic Payment Systems 5.8 Public Policy 5.9 From Legal Issues to Privacy 5.10 EC-Related Legal Incidents 5.11 Legal, Ethical, Protecting Privacy 5.12 Protecting Intellectual Property	12

References:

1. David Whiteley, e-Commerce, Tata McGraw Hill, 2000.
2. Eframi Turban, Jae Lee, David King, K. Michale Chung, Electronic Commerce, Pearson Education, 2000 5SP1: LAB I-5ST1+5ST2: Minimum 8 practicals on each.

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI
Title: Computer Science Practical - III
PAPER CODE: CSC3611

[Credits - 2]

Sr. No.	Title of Experiment / Practical
1	CPU Scheduling - FCFS
2	CPU Scheduling - Priority Preemptive
3	CPU Scheduling - Priority Non-Preemptive
4	Banker's Algorithm - I
5	Banker's Algorithm - II
6	Demand Paging - FIFO
7	Demand Paging - LRU
8	File Allocation - Continuous
9	File Allocation - Linked
10	Disk Scheduling - I

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI
Title: Computer Science Practical - IV
PAPER CODE: CSC3612

[Credits - 2]

Sr. No.	Title of Experiment / Practical
1	Collections
2	Database Programming
3	Servlet
4	Servlet and Database
5	JSP
6	JSP & Database
7	Multithreading
8	Networking
9	Designing a website
10	Case Study

T. Y. B.Sc. (COMPUTER SCIENCE) Semester – VI
Title: Computer Science Project - II
PAPER CODE: CSC3613

[Credits - 2]

Sr. No.	Title of Experiment / Practical
1	Problem Definition and Feasibility Study
2	Gathering Data Requirements and Functional Requirements
3	Entity Relationship Diagram, Designing the normalized Database
4	UML Diagrams
5	I/O screens
6	Test Case Design
7	Coding and Implementation
8	Coding and Implementation
9	Coding, Testing and Debugging
10	Documentation
11	Final Demo