

**Deccan Education Society's
FERGUSSON COLLEGE (AUTONOMOUS),
PUNE**

Syllabus

For

T. Y. B. Sc. (Computer Science)

[Pattern 2019]

(B.Sc. Semester-V and Semester-VI)

From Academic Year

2021-2022

Deccan Education Society's
Fergusson College (Autonomous), Pune
T.Y.B.Sc. Computer Science (Pattern 2019)

From Academic Year 2021-2022

Semester	Paper No.	Course Code	Title of Paper	Credits	CE Maximum Marks	ESE Maximum Marks	Total Maximum Marks
V	DSE-1A	CSC3501	Operating System-I	2	50	50	100
	DSE-1B	CSC3502	Fundamentals of Data Science	2	50	50	100
	DSE-2A	CSC3503	Java Programming –I	2	50	50	100
	DSE-2B	CSC3504	Web Development-I	2	50	50	100
	DSE-3A	CSC3505	Computer Networks-II	2	50	50	100
	DSE-3B	CSC3506	Theoretical Computer Science	2	50	50	100
	DSE-1	CSC3507	Computer Science Practical-V	2	50	50	100
	DSE-2	CSC3508	Computer Science Practical-VI	2	50	50	100
	DSE-3	CSC3509	Computer Science Project-I	2	50	50	100
	SEC-1*	CSC3511	Software Testing and Automation Tools	2	50	50	100
	SEC-2*	CSC3512	Python Programming	2	50	50	100

VI	DSE-4A	CSC3601	Operating System-II	2	50	50	100
	DSE-4B	CSC3602	Data Analytics	2	50	50	100
	DSE-5A	CSC3603	Java Programming -II	2	50	50	100
	DSE-5B	CSC3604	Web Development -II	2	50	50	100
	DSE-6A	CSC3605	Design and Analysis of Algorithms	2	50	50	100
	DSE-6B	CSC3606	Artificial Intelligence	2	50	50	100
	DSE-4	CSC3607	Computer Science Practical-VII	2	50	50	100
	DSE-5	CSC3608	Computer Science Practical-VIII	2	50	50	100
	DSE-6	CSC3609	Computer Science Project-II	2	50	50	100
	SEC-3*	CSC3611	e-Commerce	2	50	50	100
	SEC-4*	CSC3612	User Interface Design	2	50	50	100

T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Operating System -I CSC3501	Number of Credits :2
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	List the elements of the programming environment. Differentiate system programming and application programming.	
CO2	Transform the algorithms into code to implement the various system programs.	
CO3	Apply the knowledge of process concept and Linux system calls to implement a command interface (Shell).	
CO4	Explain various system services and its examples, system calls and its types.	
CO5	Compare computer system architectures, discuss operating system operations.	
CO6	Write assembly programs and explain the process of translation, execution.	

Unit. No.	Title of Unit and Contents	No. of Lectures
I	Introduction Types of program - System program and Application program, Difference between system programming and application programming, Elements of programming environment - Editor, Preprocessor, Assembler, Compiler, Interpreter, Linker and Loader, Debugger, Device drivers, Operating System	3
II	Assembler Elements of Assembly Language Programming, Simulation of simple computer smaco (hypothetical computer) – Memory, Registers, Condition Codes, Instruction format, Instruction Set, smacoprogram, smaco programs- Translation and Execution, A simple Assembly scheme, Pass structure of Assemblers, Design of Two-pass Assembler , Macro Assembler	14
III	Linker and Loader Introduction, Concept of binding - static and dynamic, Concept of addresses - translated, linked and load time addresses, Relocation and linking concept – program relocation, performing relocation, public and external references, linking, binary program, object module, Types of Loaders – compile-and-go, absolute, relocating and direct-linking, Relocatability - no relocatable, relocatable, and self-relocating programs, Linking for Overlays	5
IV	Operating System as System Software What Operating Systems Do – User View, System View, Defining OS, Computer System Architecture – Single processor system, Multiprocessor systems, Clustered Systems Operating System Operations – Dual mode operation,	5

	Privilege, Instruction, Timer, Process Management, Memory Management, Storage Management – File system management, Mass storage management, Caching, I/O systems Protection and Security , Distributed Systems, System Boot	
V	System Structure Operating System Services, User Operating-System Interface – Command interpreter, GUI, System Calls, Types of System Calls – Process control, File management, Device management, Information maintenance, Communication, Protection, Linux System calls - file and directory management	5
VI	Process Concept Process concept- Process, Process State, PCB , Process scheduling, Operations on processes, Linux System calls – process	4

References:

1. D. M. Dhamdhere, Systems Programming and Operating Systems, 2nd Revised Edition, 2011
2. Silbertchatz, Galvin, Gagne, Operating System Concepts - Willey Publication (8th Edition), 2011
3. John R. Levine, Elsevier Moegan Kaufmann, Linkers and Loaders, 2000
4. Leland L. Beck, System Software - An introduction to Systems Programming, Pearson Education, 1997
5. John J. Donovan, Systems Programming, McGraw Hill Education, 1991

Web contents-

1. www.geeksforgeeks.org
2. www.tutorialspoint.com

e-resources-

1. <https://nptel.ac.in/courses/106/105/106105214/>
2. <https://epgp.inflibnet.ac.in/>

T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Fundamentals of Data Science CSC3502	Number of Credits :2
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Describe data model and CRISP – DM.	
CO2	Discuss various applications of data science.	
CO3	Calculate statistical measures for the given dataset.	
CO4	Identify methods for data preprocessing.	
CO5	Determine the data visualization method to represent the data.	
CO6	Collect data, apply data preprocessing, and visualize the data for the given case study.	

Unit. No.	Title of Unit and Contents	No. of Lectures
I	Introduction Essential of data, what is Data Analysis? Applications of Data Science	2
II	Frameworks of Data Science Introduction , Frameworks in data science, CRISP-DM Methodology	5
III	Essentials of Statistical Learning Basics of Statistics: mean, median, standard deviation, variance, correlation, covariance, Introduction to Regression	7
IV	Data Pre-processing Data collection, Why Pre-processing?Methods of pre-processing, Data Cleaning, Data Integration, Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling, Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis	10
V	Data Visualization Data Representation, Data Exploration, Plotting the data Types of graphs, Histogram, Scatterplot, Barplot, Box plot Working with interactive charts	10
VI	Case study	2

References:

1. Bill Lubanovic, "Introducing Python- Modern Computing in Simple Packages", O' Reilly Publication, 2014
2. C R Kothari, Quantitative Techniques, 3rd revised Edition, 2013
3. The R Book Michel J. Crawley Second Edition, Wiley publication, December 2012
4. Ronald E Walpole, Sharon L Myres, Keying Ye, Probability and Statistics for Engineers and Scientist, 8th Edition, Pearson, 2007

Web contents-

1. www.analyticsvidya.com
2. www.udemy.com
3. <https://towardsdatascience.com/machine-learning/home>

e-resources-

1. <http://epgp.inflibnet.ac.in/>

T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Java Programming -I CSC3503	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	List the basics of object-oriented programming.	
CO2	Illustrate the strong features of Java.	
CO3	Implement file handling using different classes.	
CO4	Classify different types of inheritance and exceptions.	
CO5	Compare different Java libraries.	
CO6	Design GUI based applications using swing and applet.	

Unit. No.	Title of Unit and Contents	No. of Lectures
I	Fundamentals of Java Programming Introduction to Object Oriented Programming, Basic Concepts of Object-Oriented Programming, History of Java, features of java, Java Tools – jdb, javap, javadoc, javah, appletviewer, Simple Java program, Structure of Java program, Arrays and its application, accepting input using command line argument Simple programs using, Conditional Statement (if – else, Switch, Loops (while, do-while, for, for-each)	5
II	Objects and Classes Defining Classes, Access Specifiers (public, protected, private, default), Array of Objects, Constructor, Overloading	6

	Constructors and use of ‘this’ Keyword , Static block, static Fields and methods, Predefined class – Object class methods (equals (), toString(), getClass()), Creating, Accessing and using Packages, Wrapper Classes	
III	Inheritance and Interface Inheritance Basics (extends Keyword) and Types of Inheritance, Super class, Subclass and use of Super Keyword Method Overriding and runtime polymorphism, Use of final keyword related to method and class, Use of abstract class and abstract methods, Interfaces, Defining and Implementing Interfaces, Runtime polymorphism using interface	5
IV	Exception Handling Dealing Errors, Exception class, Checked and Unchecked exception, Catching exception and exception handling, Creating user defined exceptions	4
V	Strings, Streams and Files String class and String Buffer Class, Using the File class Stream classes, Byte Stream classes, Character Stream Classes, Creation of files, Reading/Writing characters and bytes, Handling primitive data types	5
VI	User Interface Components and Event Handling – Swing What is Swing? The MVC Architecture and Swing, Layout Manager and Layouts, The JComponent class, Components – JButton, JLabel, JText, JTextArea, JCheckBox and JRadioButton, JList, JComboBox, JMenu and JPopupMenu Class, JMenuItem and JCheckBoxMenuItem, JRadioButtonMenuItem, JScrollBar, Dialogs (Message, confirmation, input), JFileChooser, JColorChooser, Event Handling: Event sources, Listeners, Mouse and Keyboard Event Handling, Adapters	11

References:

1. E. Balagurusamy, Programming with Java, A primer, Fourth edition, Tata McGraw Hill Education Private Limited, 2009
2. Steven Horlznr, Java 2 programming Black Book, Dreamtech Press, 2008
3. Cay S. Horstmann, Gary Cornell, “Core Java Volume-I-Fundamentals”, 8thEdition, Prentice Hall, Sun Microsystems Press, 2007
4. Herbert Schildt, “Complete reference Java (5th edition)”, Tata McGraw Hill Edition, 2005
5. E. Balaguruswamy, “Object Oriented Programming with C++”, Tata McGraw- Hill Publishing Company Limited, 2003
6. Cay S. Horstmann, Gary Cornell, “Core Java Volume-II Advanced Features”, Eighth Edition, Prentice Hall, Sun Microsystems Press, 2001

Web contents-

1. <http://www.javatpoint.com>
2. <https://www.tutorialspoint.com>
3. <https://www.geeksforgeeks.com>

e-resources-

1. <https://epathshala.nic.in/>

T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Web Development-I CSC3504	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Describe different web technologies and application development issues and trends.	
CO2	Distinguish between server-side and client-side web technologies.	
CO3	Apply CSS types for different web pages.	
CO4	Explain different components and technologies of World Wide Web as a platform.	
CO5	Validate web form fields using JavaScript.	
CO6	Design and develop websites using fundamental web languages, technologies, and tools.	
Unit. No.	Title of Unit and Contents	No. of Lectures
I	Web Basics and HTML The Internet: Web clients, Web servers, Basic Internet protocols, Client Server Architecture – Two-Tier, Multi-Tier, HTTP Request and Response, URL, Introduction to HTML, Basic structure of an HTML document, Mark up tags: heading, paragraphs, line breaks, Working with text, Lists, Tables, Frames, Working with hyperlinks, Working with Images, Forms	6
II	Cascading Style Sheets Introduction, Syntax, and selectors, Ways to insert CSS CSS Properties –Colors, Background, Border, Margin, Padding, Height and Width, Text Formatting, List, Tables, Layout - The display property, The position property	6
III	JavaScript Introduction to JavaScript, JavaScript Basics –Data Types, Control Structure, JavaScript Functions, Working with events, JS popup boxes, JavaScript	12

	Objects, JavaScript HTML DOM, Form Validation, jQuery Syntax, jQuery Selectors, Events and Effects, Introduction to JSON.	
IV	Server-Side Scripting Using PHP Introduction, Language Basics: variables, data types, operators, expressions, constants, decisions and loop making decisions, Functions in PHP, include and require, Form processing	6
V	Strings and Array Creating and accessing String, String related library functions Regular Expressions, Creating arrays, Index and Associative array, Array related library functions	6

References:

1. Ellie Quigley, "JavaScript by Example", Pearson Education, Inc., 2011
2. DT Editorial Services, "HTML 5 Black Book", Dreamtech Press, 2010
3. Kogent Learning Solutions Inc., "Web Technologies, Black Book", Dreamtech Press, 2009
4. P.J. Deitel & H.M. Deitel, "Internet & World Wide Web How to Program (4th Edition)", Pearson –Prentice Hall, 2000

Web contents-

1. <https://www.w3schools.com>
2. <https://www.php.net.in>
3. <http://html.net>
4. <http://www.programmersneed.com>

e-resources-

1. <https://epgp.inflibnet.ac.in>

T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Computer Networks- II CSC3505	Number of Credits :2
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Describe different protocols operating at transport and application layer.	
CO2	Discuss network security concepts.	
CO3	Solve problems based on cryptography.	
CO4	Explain and determine different error detection and correction methods.	
CO5	Compare TCP and UDP protocols.	
CO6	Specify web architecture and HTTP.	

Unit. No.	Title of Unit and Contents	No. of Lectures
I	The Transport Layer Process-to-Process Delivery Client Server Paradigm, Multiplexing and De-multiplexing, Connectionless Vs Connection-Oriented Service, Reliable Vs Unreliable, UDP, TCP	3
II	User Datagram Protocol Datagram Format, Checksum, UDP operations , Use of UDP	3
III	Transmission Control Protocol TCP Services – Process to Process Communication, Stream Delivery Service, sending and Receiving Buffers, Segments, Full –Duplex Communication, Connection oriented service, Reliable service, TCP Features –Numbering System, Byte Number, Sequence Number, Acknowledgement Number, Flow Control, Error Control, Congestion Control, TCP Segment – Format, TCP connection, Error Control, Flow Control, Congestion Control – open loop and close loop	6
IV	The Application Layer Domain Name System (DNS) Name Space, Domain, Name Space, Distribution of Name Space, DNS in the Internet, Resolution, E-MAIL Architecture, User Agent, Message Transfer Agent-SMTP, Message Access Agent-POP3, IMAP4, Web Based Mail, File Transfer Protocol (FTP) Communication over control connection, Communication over Data Connection, Anonymous FTP, WWW Architecture, WEB Documents, HTTP - HTTP Transaction, Persistent and Non persistent Connection, Proxy Server	12
V	Network Security Introduction, The Need for Security, Security Approaches Principles of Security, Types of Attacks, Cryptography: Concepts and Techniques – Introduction, plain text and cipher, Substitution techniques – Caesar Cipher, Modified version of Caesar Cipher, Mono-alphabetic Cipher (Problems should be covered), Communication Security Firewalls, Social Issues - Privacy, Anonymous Remailers, Freedom of Speech, Steganography, Copyright	12

References:

1. Behrouz Forouzan, Data Communication and Networking, TATA McGraw Hill, 4thEdition, 2011
2. Andrew S. Tanenbaum, Computer Networks, ISBN:788177581652, Pearson, 4th Edition, 2007
3. Atul Kahate, Cryptography and Network Security, TATA McGraw Hill, 2003

Web contents-

1. <https://en.wikipedia.org/wiki/>
2. https://www.researchgate.net/publication/291762312_Secure_e-learning_and_cryptography
3. <https://www.irjet.net/archives/V5/i1/IRJET-V5I195.pdf>
4. www.coursera.org/
5. <https://nptel.ac.in/courses/106/105/106105081/>
6. https://www.eecis.udel.edu/~bohacek/videoLectures/ComputerNetworking/ComputerNetworking_v2.html

e-resources-

1. <https://gradeup.co/>
2. greekstogreeks.com/
3. <https://vardhaman.org/cse-e-resources-5/>
4. <https://www.dsce.edu.in/e-resources-publishers-wise>
5. <https://www.springer.com/gp/book/>
6. Behrouz Forouzan
https://www.academia.edu/37068318/Data_Communications_and_Networking_By_Behrouz_A_Forouzan
7. <https://www.mhhe.com/engcs/compsci/forouzan/frontmatter.pdf>
8. Andrew Tanenbaum:- <https://www.pdfdrive.com/andrew-s-tanenbaum-e42234094.html>

T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Theoretical Computer Science CSC3506	Number of Credits :2
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Define basic concepts of automata theory and describe various forms of grammar to know functioning, capabilities and limitations of computers.	
CO2	Explain and construct finite state systems and Context Free Grammar for the given language. Construct regular expressions to recognize patterns and PDA, Turing machine to recognize various computing languages or problems.	
CO3	Apply various techniques and algorithms to transform computing models and grammar.	
CO4	Analyze and simplify CFG, classify various grammars according to the Chomsky hierarchy.	
CO5	Evaluate various classes of problems, grammar, languages, and language recognizer machines.	
CO6	Integrate the concepts of finite automata, regular expression and context free grammar to create a LEX and YACC programs. Create regular expression for regular languages to recognize patterns.	

Unit. No.	Title of Unit and Contents	No. of Lectures
I	Introduction Symbol, Alphabet, String, Prefix & Suffix of Strings, Formal Language, Operation on Languages, Regular Expression (RE) Definition and Example, Regular Expression Identities	3
II	Finite Automata Deterministic Finite Automaton (DFA) Definition and Examples Nondeterministic Finite Automaton (NFA) Definition, NFA with ϵ - Transitions Definition and Examples NFA with ϵ - Transitions to DFA Examples Finite Automaton with output – Mealy and Moore Machine Definition and Examples Minimization of DFA Application: DFA as Language Recognizer, DFA as Pattern, Recognizer, Lexical Analyzer- LEX Example	12
III	Regular Languages Regular language Definition and Examples Conversion of RE to FA Examples Pumping Lemma for regular languages, Closure Properties of regular languages	4
IV	Context Free Grammar and Languages Grammar Definition and Examples, Derivation and Reduction Definition and Examples, Chomsky Hierarchy, Context Free Grammar (CFG) Definition and Examples, LMD, RMD Ambiguous Grammar concept and Example Simplification of CFG - Removing Useless Symbols, Removing Unit Production, Removing ϵ Productions & Nullable Symbols Normal Forms - Chomsky Normal Form (CNF) Method and Example, Greibach Normal Form (GNF) Method and Example Regular Grammar Definition, Left Linear and Right Linear Grammar Definition and Example Applications of CFG	10
V	Push Down Automaton and Turing Machine PDA Model and Definition, Construction of PDA using empty stack method, CFG to PDA Method and Example, Turing Machine Model and Definition, TM as Language Recognizer example, Language accepted by TM, Decision Problem, Undecidable Problem, Halting Problem of TM	7

References:

1. John Hopcroft, Rajeev Motwani and Jeffrey Ullman, "Introduction to Automata theory, Languages and computation", 3rd edition Pearson Education, 2009

2. Daniel I. A. Cohen, John Wiley & Sons, "Introduction to Computer Theory", 2nd edition, 2009
3. John E. Hopcroft and Jeffrey Ullman, "Introduction to Automata theory, Languages and computation", Narosa Publishing House, 1979.

e-Resources –

1. <https://epgp.inflibnet.ac.in>
2. <https://nptel.ac.in>

T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Computer Science Practical - V CSC3507	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	List the errors and warnings in an assembly program.	
CO2	Explain and demonstrate the process of assembly program translation, execution, command line-interpreter (extended shell).	
CO3	Apply different system calls for process creation, execution and its termination.	
CO4	Identify and design various data structures and represent it in tabular format	
CO5	Validate the input and execute the programs with test inputs.	
CO6	Write modularized program code for implementing various System programs and integrate them.	

List of practicals (Compulsory 10 + 2 Activity)

Sr. No.	Title of Experiment/ Practical
1	Assembler 1
2	Assembler 2
3	Assembler 3
4	Assembler 4
5	Simulator 1
6	Process creation
7	Handling shell 1
8	Handling shell 2
9	Handling shell 3
10	Handling shell 4
11	Activity

12	Activity
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T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Computer Science Practical - VI CSC3508	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	List different programming concepts to understand the designing of simple program.	
CO2	Explain the importance of Object-oriented application design.	
CO3	Implement the concept of interface and packages for real time application. Use HTML tags and CSS to design web page layout. Apply different styles to web pages.	
CO4	Classify exceptions to handle run time errors and build the user defined exceptions.	
CO5	Test and validate the programs for given inputs.	
CO6	Write programs using JavaScript. Develop user friendly applications based on MVC architecture.	

List of practicals (Compulsory 10 + 2 Activity)

Sr. No.	Title of Experiment / Practical
1	Classes and Objects
2	Packages
3	Inheritance
4	Exception Handling and File Handling
5	Swing
6	Activity
7	Creating HTML page
8	Cascade Style Sheets
9	JavaScript

10	Functions in PHP
11	Strings and Array
12	Activity

T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Computer Science Project - I CSC3509	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Define system scope and description.	
CO2	Outline the data and functional requirement.	
CO3	Demonstrate ER-Modelling.	
CO4	Analyze classes and construct Class Diagrams.	
CO5	Select the technology for the project.	
CO6	Build the input / output screen.	

List of Practicals (Compulsory 10 + 2 Activity)

Sr. No.	Title of Experiment / Practical
1	Problem definition
2	Feasibility study with Technical Requirements
3	Gathering Data Requirement and Functional Requirement
4	Entity Relationship diagram or Flowchart (For Non-Database Projects)
5	Designing the Normalized Database
6	Database Creation (using SQL)
7	Use Case Diagram
8	Input/output Screens
9	Class Diagram
10	Coding and Implementation of Input/Output screen
11	Activity (Project Demo)

12	Experimental Activity on Computer Network
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T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Software Testing and Automation Tools CSC3511	Number of Credits :2
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Describe the need of software testing and list different types of defects.	
CO2	Discuss the basic concepts of testing techniques and illustrate various types of testing.	
CO3	Apply software testing skills in different domains and develop test plans for evaluation.	
CO4	Detect the issues in software applications.	
CO5	Select appropriate automation tool for testing and analyze its effectiveness.	
CO6	Write the test cases to improvise the efficiency of the application.	

Unit. No	Title of Unit and Contents	No. of Lectures
I	Software Testing Fundamentals Software testing- Definition, Importance of Testing, Role of Tester, Software Testing Principles, Software Testing Life Cycle Defects - Definition and types of defects, Defect Management Process, Defect/Bug Life Cycle	4
II	Types of Testing Manual Testing- Black Box testing, White Box testing Unit testing, System testing, Integration testing and Acceptance testing Automation testing- Automation Testing, Automated Testing Process, Test tool selection, Framework for Automation Types of Automated Testing and Automation Testing Tools Regression Testing Non-Functional Testing	8
III	Test Case Development Overview of Test Documentation, Writing Test Cases, Test Analysis, Requirements Traceability Matrix (RTM), Test Data Generation: and What is, How to, Example, Tools	4
IV	Testing Techniques	6

	Software Testing Techniques with Test Case Design, Boundary Value Analysis & Equivalence Partitioning, Decision Table Testing, State Transition Testing, Use Case Testing, Agile Methodology and Scrum Testing Methodology	
V	Testing Different Domains Web Application Testing, Finance domain Application testing, e-Commerce testing Telecomm, and Healthcare and insurance domain testing	8
VI	Automated software testing tools Introduction to different software testing tools and Automation tools	6

References:

1. Srinivasan Desikan, "Software Testing Principals and practices", Pearson Publication ISBN-13 978-8-17-758295-6, 2013
2. Glenford J. Myers, Corey Sandler, Tom Badgett, "The Art of Software Testing", 3rd Edition ISBN: 978-1-118-13315-6, 2011
3. Kshirasagar Naik And Priyadarshi Tripathy, "Software testing and quality assurance: Theory and Practice", A John Wiley & Sons, Inc., Publication, ISBN 978-0-471-78911-6, 2008

Web Contents-

1. www.tutorialspoint.com
2. <https://www.javatpoint.com/software-testing-tutorial>
3. <https://www.guru99.com/software-testing.html>

e-resources-

1. <http://epathshala.nic.in/>
2. <https://www.coursera.org/>
3. <https://inflibnet.ac.in/>

T. Y. B.Sc. Semester V		
Title of the Course and Course Code	Python programming CSC3512	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Recall the various basic programming concepts and apply them in Python programming.	
CO2	Illustrate the various data structures in Python.	
CO3	Use various GUI libraries to select and design GUIs for appropriate applications.	
CO4	Explain various object-oriented features through Python.	
CO5	Select and apply appropriate Python packages for Data Visualization to represent data in graphical format.	
CO6	Write programs to handle data using the Pandas library.	

Unit. No	Title of Unit and Contents	No. of Lectures
I	Fundamentals of Python Variables, expression statements, Control Structures, Functions	6
II	Data Structures String, List, Tuple, Set, Dictionary	4
III	Classes and Objects Creating classes, instance objects, accessing members, Built-in class attributes, Garbage collection: the constructor, Inheritance - implementing a subclass, overriding methods, Exception Handling	4
IV	Database handling in Python Database connector, accessing connector module, using connect, cursor, execute & close functions, Reading single & multiple results of query execution, Executing different types of statements	5
V	GUI Programming What is GUI? Advantages of GUI, Introduction to GUI library. Layout management, events and bindings, fonts, colours, drawing on canvas , Python Widgets	5
VI	Data Visualization in Python Working with matplotlib library, Scatter plot, Line plot, Bar plot, Histogram	4
VII	Working with Data Reading and writing files, Loading data with pandas , Working with and saving data with pandas, Data cleaning in Python	8

References:

1. John Paul Mueller, “Beginning Programming with Python for Dummies Paperback”, 2015
2. Bill Lubanovic, “Introducing Python- Modern Computing in Simple Packages”, O’Reilly Publication, 2014
3. Paul Gries, “Practical Programming: An Introduction to Computer Science Using Python 3”, Pragmatic Bookshelf, 2/E 2014
4. Magnus Lie Hetland, “Beginning Python: From Novice to Professional”, Apress, 2008
5. Charles Dierbach, “Introduction to Computer Science Using Python”, Wiley Publication Learning with Python, Green Tea Press, 2002

Web contents-

1. www.javatpoint.com
2. www.tutorialspoint.com
3. A Beginner’s Python Tutorial: http://en.wikibooks.org/wiki/A_Beginners_Python_Tutorial.

e-resources-

1. www.geeksforgeeks.com

2. e-Books: python_tutorial. pdf, python_book_01.pdf

T. Y. B.Sc. Semester VI		
Title of the Course and Course Code	Operating System -II CSC3601	Number of Credits :2
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Describe different concepts of operating system.	
CO2	Discuss the concept of file systems and free space management.	
CO3	Apply deadlock handling techniques to determine existence of deadlock and recover it.	
CO4	Explain the concepts of memory management.	
CO5	Compare and analyze the performance of different algorithms.	
CO6	Write and implement different operating system related algorithms.	

Unit. No	Title of Unit and Contents	No. of Lectures
I	Process Scheduling Basic Concept - CPU-I/O burst cycle, CPU scheduler, Preemptive, Scheduling, Dispatcher , Scheduling Criteria Scheduling Algorithms - FCFS, SJF, Priority scheduling, Round-robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling	7
II	Deadlocks System model Deadlock Characterization - Necessary conditions, Resource allocation graph Deadlock Prevention Deadlock Avoidance - Safe state, Resource allocation graph algorithm, Banker's Algorithm, Deadlock Detection Recovery from Deadlock - Process termination, Resource Preemption	7
III	Process Synchronization Background, Interprocess Communication, Critical Section Problem, Semaphores: Usage, Implementation	3

IV	Memory Management Background - Basic hardware, Address binding, Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries Swapping Contiguous Memory Allocation - Memory mapping and protection, Memory allocation, Fragmentation Paging - Basic method, Hardware support, Protection, Shared Pages Segmentation - Basic concept, Hardware, Virtual Memory Management - Background, Demand paging, Performance of demand paging, Page replacement - FIFO, OPT, LRU, Second chance page replacement	12
V	File System File concept Access Methods - Sequential, Direct, Other access methods Directory and Disk Structure – Storage structure, Directory overview, Single level directory, Two level directory, Tree structure directory, Acyclic graph directory, General graph directory Allocation Methods - Contiguous allocation, Linked allocation, Indexed allocation, Free Space Management - Bit vector, Linked list	7

References:

1. Pabitra Pal Choudhary, “Operating Systems: Principles and Design”, PHI Learning Pvt. Ltd., 2011
2. Siberchatz, Galvin, Gagne, “Operating System Concepts” Willey Publication (8th Edition), 2008

Web contents-

1. <https://www.tutorialspoint.com/android/index.htm>
2. www.geeksforgeeks.org
3. www.tutorialspoint.com

e-resources

1. <https://nptel.ac.in/courses/106/105/106105214/>
2. <http://epgp.inflibnet.ac.in/>

T. Y. B.Sc. Semester VI		
Title of the Course and Course Code	Data Analytics CSC3602	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Define the key objectives of data analytics and describe its scope in different domains.	
CO2	Explain relationship between variables. Synthesize the correlation between two quantitative variables using statistical terms.	

CO3	Classify various machine learning techniques.
CO4	Integrate machine learning algorithms/techniques to construct use case-based models and achieve expected accuracy.
CO5	Evaluate performance of algorithms using evaluation.
CO6	Construct models using various algorithms.

Unit. No	Title of Unit and Contents	No. of Lectures
I	Introduction to Data Analytics Inferential Statistics – Motivation, Inferential Statistics - Single sample tests, Two Sample tests, Type 1 and Type 2 Errors, Confidence Intervals, ANOVA and Test of Independence	8
II	Introduction to Machine Learning Supervised Learning, Unsupervised Learning, Reinforcement Learning, Training Vs Testing, Performance Evaluation measures	6
III	Supervised Learning Logistic Regression, Training a Logistic Regression Classifier Classification and Regression Trees, Naïve Bayes , Ensemble Methods and Random Forests, Bias Variance Dichotomy, Model Assessment and Selection	12
IV	Unsupervised Learning Clustering, Types of clustering, K-means clustering, Associative Rule Mining: Overview, Mining association rule	8
V	Case Study	2

References:

1. Yu-Wei, Chiu (David Chiu), “Machine Learning with R cookbook” First Edition PACKT publishing,2015.
2. Cory Lesmeister, “Mastering Machine Learning with R”, First Edition PACKT publishing,2015
3. Ian Witten Eibe Frank Mark A. Hall, “Data Mining Practical Machine Learning Tools and Techniques”, Third Edition Morgan Kaufmann Publishers First Edition, 2011
4. Jiawei Han, MichelineKamber, Jian Pei, “Data Mining: Concepts and Techniques”, 3rd Edition, 2011
5. R. O. Duda, P. E. Hart, D. G. Stork, “Pattern Classification”, 2nd edition. John Wiley and Sons, 2000

Web contents-

1. www.analyticsvidya.com
2. www.udemy.com
3. <https://towardsdatascience.com/machine-learning/home>

e-resources-

1. <http://epgp.inflibnet.ac.in/>

T. Y. B.Sc. Semester VI		
Title of the Course and Course Code	Java Programming -II CSC3603	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Recall the object-oriented features to design platform independent applications.	
CO2	Represent dynamic data structures using Collection Framework.	
CO3	Implement game designing using multithreading concepts.	
CO4	Identify the errors by testing the applications.	
CO5	Decide the appropriate technology for designing web applications.	
CO6	Integrate the concept of database and GUI to design user friendly applications.	

Unit. No	Title of Unit and Contents	No. of Lectures
I	Collection Introduction to the Collection framework List –ArrayList, LinkedList and Vector, Stack, Queue Set -HashSet, TreeSet, and LinkedHashSet Map –Hash Map, LinkedHashMap, Hashtable and TreeMap Interfaces such as Comparator, Iterator, List Iterator	3
II	Database Programming The design of jdbc, jdbc configuration, Types of drivers, Executing SQL statements, query execution, Scrollable and updatable result sets Metadata–DatabaseMetadata, ResultSetMetadata Transactions –commit(), rollback(), SavePoint (Database : PostgreSQL)	8
III	Multithreading What are threads? Life cycle of a thread , Running and starting thread using Thread class, Thread priorities, Running multiple threads, The Runnable interface, Synchronization and interthread communication	6
IV	Servlet Introduction to Servlet and hierarchy of Servlet, Life cycle of servlet Tomcat – Introduction, configuration, Handling Get and Post request (HTTP), Handling a data from HTML to servlet, Retrieving a data from database to servlet Session tracking – Authorization, URL rewriting, Hidden	5

	form fields, Cookies, Http Session	
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V	JSP Life cycle of JSP, Implicit Objects Scripting elements –Declarations, Expressions, Scriptlets, Comments, Simple first JSP program JSP Directives -Page directive, include directive Mixing scriptlets and HTML Example of forwarding contents from database to servlet, servlet to JSP and displaying it using JSP scriptlet tag User defined functions in JSP, Web, designing using JSP, Session handling	10
VI	Networking Networking basics – Protocol, Addressing, DNS, URL, Socket, Port The java.net package –InetAddress, URL, URLConnection class SocketServer and Socket class , Creating a Socket to a remote host on a port (creating TCP client and server), Simple socket program examples	4

References:

1. E. Balagurusamy, “Programming with Java , A primer”, Fourth edition , Tata Mcgraw Hill Education Private Limited, 2009
2. Steven Horlzner, “Java 2 programming Black Book”, Dreamtech Press, 2008
3. Bryan Basham, Kathy Sierra and Bert Bates ,“The Brain Friendly study Guide Head First Servlets and JSP”, Second Edition, O’Reilly Publications, 2008
4. Cay S. Horstmann, Gary Cornell,“Core Java Volume-I-Fundamentals”, Eighth Edition,Prentice Hall, Sun Microsystems Press, 2007
5. Herbert Schildt, “Complete reference Java”, Fifth Edition, Tata McGraw Hill Edition, 2005
6. Cay S. Horstmann, Gary Cornell,“Core Java Volume-II Advanced Features”, Eighth Edition, Prentice Hall, Sun Microsystems Press, 2001

Web contents-

1. <http://www.javatpoint.com>
2. <https://www.tutorialspoint.com>
3. <https://www.geeksforgeeks.com>

e-resources-

1. <https://epathshala.nic.in/>

T. Y. B.Sc. Semester VI		
Title of the Course and Course Code	Web Development-II CSC3604	Number of Credits :2
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	Describe concept of Object-Oriented Programming, file, and XML.	
CO2	Represent AJAX model to develop interactive web pages.	
CO3	Implement database connectivity and AJAX with PHP to generate dynamic and interactive web pages.	
CO4	Distinguish PHP as a server-side programming language.	
CO5	Determine how websites are built using various concepts and technologies.	
CO6	Develop the modern web pages using the HTML, CSS features with different layouts and PHP as per need of applications.	

Unit. No	Title of Unit and Contents	No. of Lectures
I	Database Connectivity with PostgreSQL Connection with PostgreSQL Database, Performing basic database operation (DML) (Insert, Delete, Update, Select), Setting query parameter, Executing query, Mini Project	8
II	Introduction to OOPs Introduction, Classes and Objects, Constructors and Destructor, Inheritance, Serialization, Abstract method and Interface	6
III	Working with file and Directories Understanding file& directory, Opening and closing a file, Coping, renaming and deleting a file, Working with directories, Creating and deleting folder , File Uploading and Downloading	6
IV	Web Techniques Super global Variables, Server information, Sticky forms, Setting response headers, Session and Cookies	6
V	XML What is XML? XML document Structure, PHP and XML, XML parser, The document object model, The simple XML extension	6
VI	AJAX Introduction to AJAX, PHP with AJAX, Working with database	4

References:

1. Matt Doyle, "Beginning PHP 5.3", Wrox Publication, 2010
2. Kogent Learning Solutions Inc., "AJAX Black Book", Dreamtech Press, 2010
3. David Sklar& Adam Trachtenberg, "PHP cookbook", O'Reilly Publication, 2010

4. Ivan Bayross&Sharanam Shah, “PHP 5.1 for Beginners”, SPD Shroff Publishers & Distributers Pvt. Ltd., 2006
5. RasmusLerdorf and Kevin Tatroe, “Programming PHP”, O’Reilly publication, 2002

Web contents-

1. <https://www.W3schools.com>
2. <https://www.php.net.in>
3. <http://www.wrox.com>
4. <http://www.programmersneed.com>

T. Y. B.Sc. Semester VI		
Title of the Course and Course Code	Design and Analysis of Algorithms CSC3605	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Identify the restrictions of the different algorithms techniques in terms of the key characteristics of problem solving.	
CO2	Explain various advanced design and analysis techniques.	
CO3	Solve the problem using Brute force techniques and integrate different solutions.	
CO4	Classify tractable and intractable problems, p and np class problems and solve them using different design techniques.	
CO5	Determine the strategy used to solve the problems that fits into various paradigms.	
CO6	Devise efficient algorithms and analyze their performance measures.	

Unit. No	Title of Unit and Contents	No. of Lectures
I	Basics of Algorithms What is Algorithm and its characteristics, Sorting algorithms (Insertion sort, Heap sort, Bubble sort) Sorting in linear time: Counting sort, concept of Bucket and Radix sort Searching algorithms: Linear, Binary	4
II	Divide and conquer strategy General method, control abstraction, Binary search, Merge sort, Quicksort	4
III	Dynamic Programming Principle of optimality, Matrix chain multiplication Shortest paths: Floyd Warshall, Bellman - Ford algorithm Longest common sub sequence, String editing, 0/1 knapsack problem, Traveling salesperson problem.	8
IV	Greedy Method	6

	Control Abstraction, Fractional Knapsack problem, Job Sequencing with deadlines, Minimum-cost spanning trees: Kruskal and Prim's algorithm, Optimal storage on tapes, Optimal merge patterns, Huffman coding Single Source Shortest Path: Dijkstra's algorithm	
V	Decrease and Conquer DFS and BFS, Topological sorting, Connected components and spanning trees, Euclid's algorithm, Flow in graph	4
VI	Backtracking General method, n-Queen's problem, Graph coloring problem Hamiltonian cycle, Sum of subsets	4
VII	Branch and Bound Concept, LIFO, FIFO and LCBB, Travelling salesman problem	4
VIII	Problem Classification Non deterministic algorithm The class of P, NP, NP-hard and NP - Complete problems Cook's theorem	2

References:

1. T. Cormen, C. Leiserson & R. Rivest, "Algorithms", MIT Press, 2009
2. Jungnickel, "Graphs, Networks and Algorithms", Springer, ISBN:3540219056, 2004
3. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, "Computer Algorithms", Galgotia, 1997
4. A. Aho, J. Hopcroft & J. Ullman, "The Design and Analysis of Computer Algorithms", Addison Wesley, 1974
5. Donald Knuth, "The Art of Computer Programming (3 vols., various editions, 1973-81)", Addison Wesley

Web contents-

1. <https://www.tutorialspoint.com>
2. <https://www.javatpoint.com>
3. <http://www.cs.cmu.edu>
4. <https://www.geeksforgeeks.org>

e-resources-

1. <https://nptel.ac.in>
2. <https://swayam.gov.in>
3. <https://mooc.org>

T. Y. B.Sc. Semester VI		
Title of the Course and Course Code	Artificial Intelligence CSC3606	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Describe historical perspective, agents, branches, applications of Artificial Intelligence (AI).	
CO2	Explain and evaluate search, control strategies and solve problems by applying a suitable search method.	
CO3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	
CO4	Analyze knowledge representation, predicate logic and simple game playing algorithms.	
CO5	Evaluate various heuristic, planning, constraint satisfaction problems to select efficient strategy to solve AI problems.	
CO6	Design and implement appropriate solutions for search problems, planning problems and write statements to transform into propositional and first order logic.	

Unit. No	Title of Unit and Contents	No. of Lectures
I	Introduction to Artificial Intelligence Overview and Historical Perspective, Turing test, Agents Branches of AI, Applications of AI	6
II	Problem Solving: State Space Search Problem Formation Components Uninformed Search Strategies- Depth First Search, Breadth First Search, Depth First Iterative Deepening Informed Search Strategies / Heuristic Search - Best First Search, Hill Climbing, Beam Search Randomized Search - Simulated Annealing, Genetic Algorithms, Ant Colony Optimization Finding Optimal Paths - Branch and Bound, A*, A*ID	14
III	Knowledge, Reasoning, Logic and Inferences Knowledge and Knowledge Representation, KR using Predicate Logic, Reasoning Logic and Inferences - Proposition Logic, First Order Logic Forward and Backward Chaining, Expert System	10
IV	Game Playing Minimax Algorithm, AlphaBeta Algorithm	3
V	Planning and Constraint Satisfaction Planning, Forward and Backward state space planning concept and example Constraint Satisfaction Concept and Example	3

References:

1. Nils J. Nilsson, “Artificial Intelligence A New Synthesis”, Morgan Kaufmann, 2013
2. Stuart J. Russell and Peter Norving, “Artificial Intelligence A Modern Approach”, Pearson, 2010
3. Elaine Rich and Kevin Knight, “Artificial Intelligence”, TATA McgrawHILL ,2008

Web content-

1. <https://geeksforgeeks.org>
2. <https://tutorialspoint.com>

e-resources-

1. <https://nptel.ac.in>
2. <https://swayam.gov.in>

T. Y. B.Sc. Semester VI		
Title of the Course and Course Code	Computer Science Practical -VII CSC3607	Number of Credits :2
Course Outcomes (COs) On completion of the course, the students will be able to:		
CO1	List the errors and warnings for the given input.	
CO2	Transform the algorithms into program code and construct appropriate data structures.	
CO3	Solve the problems based on each algorithm.	
CO4	Explain and demonstrate execution process of the programs.	
CO5	Validate the input and execute the programs with test inputs.	
CO6	Write modularized program code for implementing various operating system algorithms and integrate them.	

List of practicals (Compulsory 10 + 2 Activity

Sr. No.	Title of Experiment / Practical
1	CPU Scheduling – FCFS
2	CPU Scheduling –SJF
3	CPU Scheduling – Priority
4	Banker’s Algorithm – I

5	Banker's Algorithm – II
6	Demand Paging – FIFO
7	Demand Paging – LRU
8	Demand Paging – LFU/MFU
9	File Allocation – Continuous
10	File Allocation –Linked
11	Activity I
12	Activity II

T. Y. B.Sc. Semester VI

Title of the Course and Course Code	Computer Science Practical -VIII - CSC3608	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Define various dynamic data structures using Collection Framework in Java.	
CO2	Articulate concept of database connectivity and executing database queries.	
CO3	Demonstrate server side technology for development of web applications.	
CO4	Structure and develop dynamic web pages using PHP, XML and AJAX.	
CO5	Select appropriate technique and apply it to build game based applications.	
CO6	Write programs to implement test and validate different concepts of Java and PHP programming.	

List of practicals (Compulsory 10 + 2 Activity)

Sr. No.	Title of Experiment / Practical
1	Collection
2	Database connectivity in Java
3	Multithreading
4	JSP
5	Networking
6	Activity
7	Database connectivity in PHP

8	Object Oriented Programming
9	Working with files and directories
10	Web techniques
11	XML and AJAX
12	Activity

T. Y. B.Sc. Semester VI

Title of the Course and Course Code	Computer Science Project-II CSC3609	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Define the activities involved in project.	
CO2	Illustrate the different state of system.	
CO3	Outline the test cases.	
CO4	Structure the system using various UML diagrams.	
CO5	Test and validate all inputs.	
CO6	Develop project with code construction.	

List of practicals (Compulsory 10 + 2 Activity)

Sr. No.	Title of Experiment / Practical
1	Behavioral Modeling (Sequence Diagram, Activity Diagram)
2	State Diagram
3	Architectural Modeling(Component Diagram, Deployment Diagram)
4	Coding and Implementation
5	Test Case Design
6	Activity (Project Demo)
7	Review Activity of First Demo
8	Coding and Implementation Interlinking
9	Coding and Implementation of Events
10	Coding and Implementation Validation
11	Documentation

12	Activity (Final Project Demo)
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T. Y. B.Sc. Semester VI		
Title of the Course and Course Code	e-Commerce CSC3611	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Describe internet trading relationships.	
CO2	Explain legal and privacy issues in e-Commerce.	
CO3	Demonstrate the foundation and importance of e-commerce.	
CO4	Analyze the impact of e-commerce on business models and strategy.	
CO5	Compare the performance of electronic payment systems.	
CO6	Integrate the key features of intranet, internet, extranet and explain how they relate to each other.	

Unit. No	Title of Unit and Contents	No. of Lectures
I	Introduction to e-Commerce The Scope of Electronic Commerce, Definition of Electronic Commerce, Electronic Commerce and the Trade Cycle, Electronic Markets , Electronic Data Interchange, Internet Commerce, e-Commerce in Perspective	6
II	Business Strategy in an Electronic Age Supply Chains, Porter's Value Chain Model, Inter Organizational Value Chains, Competitive Strategy, Porter's Model, First Mover Advantage, Sustainable, Competitive Advantage, Competitive Advantage using e-Commerce, Business Strategy	8
III	Business-to-Business Electronic Commerce Characteristics of B2B EC, Models of B2B EC Procurement Management Using the Buyer's Internal, Marketplace, Supplier-Oriented, Marketplace Intermediary-Oriented Marketplace, Just-in Time Delivery Auctions and Services from Traditional to Internet-Based EDI Integration with Back-end Information Systems, The Role of Software Agents for B2B EC, Electronic Marketing in B2B Solutions of B2B EC, Managerial Issues, Electronic Data Interchange (EDI)	12
IV	Electronic Payment Systems Is SET a Failure, Electronic Payments & Protocols, Security,	10

	Schemes in Electronic Payment Systems, Electronic Credit Card System on the Internet, Electronic Fund Transfer and Debit Cards on the Internet, Stored-Valued Cards and E-Cash Electronic Check Systems, Prospect of Electronic Payment Systems, Public Policy, From Legal Issues to Privacy EC-Related Legal Incidents , Legal, Ethical, Protecting Privacy, Protecting Intellectual Property	
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References:

1. Bharat Bhasker, “Electronic Commerce Framework, Technologies and Applications”, McGraw Hill, 4th Edition, 2014
2. David Whiteley, “e-Commerce”, Tata McGraw Hill, 2000.
3. Eframi Turban, Jae Lee, David King, K. Michale Chung, “Electronic Commerce”, Pearson Education, 2000

Web contents-

1. www.geeksforgeeks.com
2. www.tutorialspoint.com

e-resources-

3. <https://nptel.ac.in>
4. <https://swayam.gov.in>

T. Y. B.Sc. Semester VI		
Title of the Course and Course Code	User Interface Design CSC3612	Number of Credits :2
Course Outcomes (COs)		
On completion of the course, the students will be able to:		
CO1	Define principles of UI Design.	
CO2	Explain the MVC (model-view-controller) design pattern.	
CO3	Apply a user centered design in the creation of basic to complex software applications.	
CO4	Explain how the observed problems can be resolved using principles of user interface design.	
CO5	Compare between usability and user experience.	
CO6	Design and develop user interfaces optimized for a range of devices and platforms.	

Unit. No	Title of Unit and Contents	No. of Lectures
I	Design Principles Usability-Dimensions of Usability Learn ability- Learning Approaches, Interaction Styles, Conceptual Models Efficiency- Chunking Pointing and Steering, Shortcuts More Learn ability- Consistency, Affordance, Feedback	12

	Locus of Attention, Information Scent More Efficiency- Human Information Processing, Keystroke level model, GOMS, Heuristic Evaluation	
II	Design Techniques User Centered Design- Iterative design, Need finding, Brainstorming Safety- Human Error, Error Prevention, Error Messages, Prototyping, Prototype fidelity, Kinds of prototypes, User Testing, Kinds of User Tests, Ethics, Formative Evaluation Graphic Design- Simplicity, Contrast & Visual Variables More Safety- User Control and Freedom, Undo Accessibility- Impairments, Universal Design, Assistive Technology, Guidelines Internationalization - Internationalization & Localization, Design Challenges, Implementation Techniques	14
III	Implementation techniques UI Software Architecture - View Tree and the Listener Pattern Model-View, GUI, Implementation Approaches Input- Input Events, Event Dispatch and Propagation, State Machines Output - Output Representations, Drawing, Strokes, Pixel Animation Principles, Animation Implementation, Debugging Output Layout - Debugging Output, White Space, Alignment and Grids Color - Human Vision, Color Models, Design Guidelines Typography - Readability, Font, Spacing, Typeface, Font Selection	10

References:

1. Everett N. McKay, "UI is Communication: How to Design Intuitive, User Centered Interfaces by Focusing on Effective Communication 1st Edition", 2013
2. Wilbent O. Galitz, "The Essential Guide to User Interface Design", John Wiley & Sons, 2007
3. Jenifer Tidwell, "Designing Interfaces", O'Reilly Publication, 2005
4. Alan Cooper, "The Essential Of User Interface Design", Wiley –Dream Tech Ltd., 2002
5. Ben Sheiderman, "Design The User Interface", Pearson Education, 1998

Web contents-

1. <https://userbrain.net>
2. <http://www.tutorialspoint.com>

e-resources-

1. <http://web.mit.edu/6.813/www/sp17/>
2. <https://course.ccs.neu.edu/cs5500sp17/09-UX.pdf>

Standard Operating Procedure for Skill Enhancement Courses

- 1) Computer Science Department offers **two Skill Enhancement Courses (SEC) per semester** with **2 credits each** at Third Year under graduate level students.
- 2) Each Skill Enhancement Course is designed to provide value-based and /or skill-based knowledge which students can imbibe and utilize it for augmenting the employability and entrepreneurship.
- 3) The Skill Enhancement Courses will be conducted in **36 lectures** (or 60 hours) that may include understanding the theory as well as practical demonstrations and will focus on Experiential Learning. This approach will help the delivery of quality education with flexibility in terms of pedagogy and operations.
- 4) **The scheme of examination:**
 - a. **Concurrent Evaluation (CE) : 50 Marks**
Home Assignment / Problem Solving/Case Studies / Mini Project / Research Paper Review : **25 Marks**

Objective Type exam : **25 Marks**
 - b. **End Semester Examination (ESE) : 50 Marks**
Subjective/Objective Type theory paper
- 5) Students will be evaluated for the CE and ESE exam and assessment will be done at Departmental Level.