
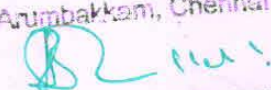




DWARAKA DOSS GOVERDHAN DOSS VAISHNAV COLLEGE
(Autonomous)
College with Potential for Excellence, Linguistic Minority Institution
Affiliated to University of Madras
Arumbakkam, Chennai – 600 106

PG DEPARTMENT OF COMPUTER SCIENCE
M.Sc. COMPUTER SCIENCE
Course Code: 27
OUTCOME BASED SYLLABUS
With effect from 2020-2021
CHOICE BASED CREDIT SYSTEM


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FIRST SEMESTER (SYLLABUS)

Course Title: DESIGN AND ANALYSIS OF ALGORITHMS

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course, student will be able to understand the fundamental approaches in the design of algorithms and the impact of algorithm design in practice, analyze the asymptotic performance of algorithm, analyze different computational models, order notation and various complexity measures, analyze and design the complexity/performance of different algorithms, to apply important algorithmic design paradigms and methods of analysis, learn insights of lower bound theory problems and NP-hard and NP-complete problems.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Know the essentials of algorithms. Analyze the asymptotic performance of algorithms. Gain insights into randomized algorithms and primality testing.
CO2	Describe the divide-and-conquer and greedy paradigm. Explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and-conquer, greedy algorithms and analyze them.
CO3	Discuss the dynamic-programming paradigm and implementation of dynamic programming in various algorithmic design and analyze them.
CO4	Define the design of backtracking, branch and bound paradigm. Describe the algorithms using this paradigm. Synthesize and analyze them.
CO5	Know the concepts of non-deterministic algorithms, Lower bounds theory problems and the classes NP-hard and NP-complete problems.
CO6	Synthesize appropriate algorithm for a design situation

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	2	2	3	2	3	3	2	2	2	2
CO 2	3	3	3	2	3	3	2	2	3	3	3	3	2
CO 3	2	3	3	2	3	3	2	3	3	3	2	3	3
CO 4	2	3	3	2	2	3	2	3	3	3	2	3	2
CO 5	2	2	2	2	2	3	3	2	3	3	2	2	2
CO 6	3	3	3	2	3	3	3	2	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
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1	UNIT I: Introduction: Definition of Algorithm – pseudo code conventions – recursive algorithms – Time and Space Complexity – Big “oh” notation – practical complexities – randomized algorithms – repeated element – primality testing.	10	CO1
2	UNIT II: Divide and conquer: General Method Quick sort, Selection sort – Finding maximum and minimum – merge sort. Greedy Method: General Method – knapsack problem – Tree vertex splitting – Job sequencing with deadline – Optimal storage on tapes.	14	CO2
3	UNIT III: Dynamic Programming: General Method – multistage graphs – all pairs shortest paths – single source shortest paths – Search techniques for graphs – DFS-BFS-connected components – biconnected components.	12	CO3
4	UNIT IV: Back Tracking: General Method – 8-queens – Sum of subsets – Graph Coloring – Hamiltonian cycles. Branch and Bound: General Method – Traveling Salesperson problem.	12	CO4
5	UNIT V: Lower Bound Theory: Comparison trees – Oracles and advisory arguments – Lower bounds through reduction – Basic Concepts of NP-Hard and NP-Complete problems.	12	CO5, CO6

TEXT BOOKS:

1. E Horowitz, S Sahni and S Rajasekaran (1997). *Computer Algorithms* (2001 edition), Galgotia Publishers, ISBN 81-7515-257-5
2. G Brassard and P Bratley (1997). *Fundamentals of Algorithms* (1st Edition), Prentice Hall India Learning Private Limited, ISBN 8120311310
3. AV Aho, JE Hopcroft, JD Ullmann (1974). *The Design and Analysis of Computer Algorithms* (1st Edition), Pearson, ISBN 0201000296

REFERENCE BOOKS:

1. Cormen Thomas H, Charles S. Leiserson, Ronald L. Rivest, Clifford Stein (2012). *Introduction to Algorithms* (3rd edition), MIT Press Ltd, ISBN 9780262033848
2. Anany Levitin (2011). *Introduction to the Design and Analysis of Algorithms* (3rd edition) Pearson, ISBN 978-0132316811
3. Jon Kleinberg, Eva Tardos (2006). *Algorithm Design* (3rd edition revised), Pearson Education, ISBN 9780132131087

E- REFERENCES:

1. www.nptel.ac.in/video.php?subjectId=106102064
2. <https://www.cs.duke.edu/courses/fall08/cps230/Book.pdf>

L:T:P:S : 4:0:0:0
Exam Hours: 03

CIA Marks : 40
ESE Marks : 60

LEARNING OBJECTIVES:

On taking this course, student will be able to learn the fundamentals of writing Python scripts using scripting elements such as variables and various flow control structures and know to work with lists and sequence data which facilitate code reuse which uses python programming to read and write files.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand the basic concepts of various operating systems and data types.
CO2	Illustrate the concept of strings and its manipulation.
CO3	Illustrate python for file handling in databases.
CO4	Understand the various graphic methods to solve different problems.
CO5	Interpret data exploration and data munging.
CO6	Gain knowledge on data science.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	1	1	3	1	3	1	1	3	3	2	2	3
CO 2	3	2	2	2	2	1	1	1	3	2	2	2	3
CO 3	3	2	2	2	2	1	1	1	3	3	3	3	2
CO 4	3	2	2	2	1	1	1	2	3	2	2	3	3
CO 5	3	3	2	2	2	2	1	1	3	3	3	3	2
CO 6	3	3	2	2	2	2	2	1	3	3	3	3	1

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
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1	UNIT I : Introduction to Python – Installing in various Operating Systems – Variables and Data Types – Operators – Conditional Statements – if-if-else-nested if – Looping – for-while-nested loops – Control Statements - break-continue-pass – Input/output Statements	5	CO1
2	UNIT II: Sequences – String Manipulations – Lists – Tuples – Mapping and Set types – Dictionaries – Set – Functions – Defining a function – calling a function – types of function – function arguments – lamda function – Exception Handling – Modules.	6	CO2
3	UNIT III : File handling – Object Oriented Programming – Classes – Objects – Attributes – Inheritance – Overloading – Polymorphism – Interacting with Databases – Introduction to MySQL – interacting with MySQL – Database connection – creating database table, insert operation, read operation, update operation, delete operation – Regular Expressions – Text handling.	7	CO3
4	UNIT IV: Introduction to Graphics programming – Introduction to GTK – PyGTK – Developing GUI applications using PyGTK – Tooltip, Check button, Combo box, Menus, Calendar, Image, Image processing – Network Programming – socket module – server socket methods – client socket methods – general socket methods – Web services using SOAP- Interpret data exploration and data munging.	17	CO4, CO5
5	UNIT V: Data Science in Python – Numpy – Numpy introduction, Data types Object – dtype – Numerical operations on Numpy arrays – Changing the dimensions of arrays – matrix arithmetic. Scipy – introduction – basic functions – special function – optimization – linear algebra – Pandas – Introduction to Series and DataFrames – reading and writing data – Data Exploration – Data Munging – Introduction to version control system – subversion/Git.	10	CO6

TEXT BOOKS:

1. Allen B Downey (2012) *Think Python: How to Think Like a Computer Scientist* (1st Edition), O'Reilly.
2. Jeff McNeil (2010) *Python 26 Text Processing: Beginners Guide*, Packet Publications.
3. Mark Pilgrim (2009) *Dive Into Python* (2nd edition), Apress publications.

REFERENCE BOOKS:

1. Kent D Lee (2010) *Python Programming Fundamentals*.
2. David M Beazley (2009) *Python Essential Reference*.
3. John V Guttag. *Introduction to Computation and Programming Using Python*, Prentice Hall of India.

E- REFERENCES:

1. <http://www.swaroopch.com/notes/python>
2. <https://docs.python.org/release/3.0.1/tutorial/>
3. <https://learnpythonthehardway.org/>
4. <https://www.python-course.eu/pandas.php>
5. <http://www.spoken-tutorial.org>

Course Title: COMPUTER NETWORKS

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course the student will be able to understand the concepts and fundamentals of data communication and computer networks, to familiarize with the basic taxonomy and terminology of computer networking area and to experience the designing and managing of communication protocols while getting a good exposure to the TCP/IP protocol suite.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Have knowledge of the basic principles, concepts of computer networks and the design of OSI layers.
CO2	To get insights into the Data Link Layer protocols
CO3	To provide overview of the Protocols of Medium Access sub layer
CO4	To identify the design issues and solutions in the Network Layer
CO5	To have basic knowledge of TCP protocol
CO6	Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	2	2
CO 2	3	3	3	3	3	3	2	2	3	3	3	2	3
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 4	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: Introduction: Network Hardware – Software – Reference Models – OSI and TCP/IP models – Physical layer: Transmission media– Wireless Transmission –Narrowband ISDN.	9	CO1

2	UNIT II: Telephones structure –local loop– trunks and multiplexing, switching. Data link layer: Design issues – error detection and correction, Elementary data link protocols – Sliding window protocols.	99	CO2
3	UNIT III: Medium Access Sub Layer: Channel Allocation Problem – Multiple Access Protocols: ALOHA– Carrier Sense Multiple Access Protocols – Collision Free Protocols – Limited Contention Protocols Bridges – Transparent Bridges – Spanning Tree Bridges – Source Routing Bridges.	9	CO3
4	UNIT IV: Network layer – design issues – Routing Algorithms: Shortest Path Routing – Flooding – Distance Vector Routing – Link State Routing – Hierarchical Routing Congestion control algorithms: General Principles – Congestion Control in Virtual Circuit Subnets – Choke Packets – Load Shedding – Jitter Control– IP protocol – IP Address – Subnets – Internet Control Protocol.	9	CO4, CO6
5	UNIT V: Transport layer –Elements– Connection management – Addressing, Establishing &Releasing a connection – Transport Control Protocol: TCP Protocol – TCP segment Header– Connection Management – Congestion control.	9	CO5, CO6

TEXT BOOKS:

1. A.S.Tanenbaum (2013). *Computer Networks* (5th Edition), Pearson Education, ISBN-13 : 978-8131770221

REFERENCE BOOKS:

1. B Forouzan (1998). *Introduction to Data Communications in Networking*, Tata McGraw Hill.
2. Halsall (1995). *Data Communications, Computer Networks and Open Systems* (20th edition), Addison Wesley.

E- REFERENCES:

1. www.technolamp.co.in/2010/08/computer-networks-tanenbaum-powerpoint.html
2. <https://www.ece.rutgers.edu/~marsic/books/CN/>

Course Title: PROGRAMMING IN PHP

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course the student will be able to develop a basic understanding of how server-side

programming works on the web and to learn basic syntax for variable types and calculations in PHP. Creating conditional structures, storing data in arrays and learn how to design using PHP built-in functions and creating custom functions in PHP. To develop the skills of designing form submission using POST and GET methods and how to receive and process form submission data in PHP. Understanding the concept of object-oriented programming in PHP, reading and writing Cookies and Sessions in PHP and to provide knowledge on how to develop the ability to write database application using MYSQL in PHP.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Develop the knowledge of Hardware and Software requirements, Installation of PHP, data types, different types of operators and Control Structures in PHP.
CO2	Implementation of arrays, Looping Structures, Functions in PHP.
CO3	Learn the concepts of File System. Working with Forms and Implementation of Regular Expressions in Forms.
CO4	Gain the Knowledge of OOPS concept.
CO5	Implementation of Database Connectivity using MYSQL and Learn the concepts of Cookies.
CO6	Implementation of Session and AJAX

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 2	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	Introduction -The Origin of PHP-PHP is better than Its alternatives-How PHP works with the Web Server-Hardware and Software requirements and installation-PHP Pros and Cons-PHP: past, present and future (PHP 3.0, PHP 4.0, and PHP 5)-Strength of PHP Basic PHP Development -How PHP scripts work-Basic PHP syntax-PHP variables-PHP data types-Displaying type information-Testing for a specific data type-Operators-Variable manipulation-Dynamic variables-String in PHP Control Structures -The if statement-Using the else clause with if statement, multiple if, nested if-The switch statement-Using the ? Operator- Summary	9	CO1
2	UNIT-II: Arrays -Single-Dimensional Arrays-Multidimensional Arrays-Casting Arrays-Associative arrays-Accessing arrays-Getting the size of an array-Looping through an array-Looping through an associative array- Examining arrays-Joining arrays-Sorting arrays-Sorting an associative arrays Loops -The while statement-The do while statement-The for statement-Break & continue Nesting loops-	9	CO2

	For each loops Functions -Introduction of functions - PHP Library Function -Array functions-String functions-Date and time functions-Other important functions- User Defined Function -Defining a function with parameters and without parameters-Returning value from function-Dynamic function calls Accessing variable with the global statement-Function calls with the static statement-Setting default values for arguments-Passing arguments to a function by value-Passing arguments to a function by reference.		
3	Working with the File System -Creating and deleting a file-Reading and writing text filesWorking with directories in PHP-Checking for existence of file-Determining file size-Opening a file for writing, reading, or appending-Writing Data to the file-Reading characters Working With Forms -Forms-Super global variables-The server array-A script to acquire user input-Importing user input-Accessing user input-Combine HTML and PHP code-Using hidden fields - Redirecting the user-File upload and scripts . Validation -Server side validation-Client side validation (Java script)-Working With Regular Expressions.	9	CO3
4	Classes And Objects -Introduction of Objects oriented programming, Define a class-Creating an object-Object properties-Object methods-Object constructors and destructors Class constants, Access modifier, Class inheritance-Abstract classes and methods-Object serialization Checking for class and method existence-Exceptions-Summary Introduction To Database -Introduction to SQL-Connecting to the MYSQL-Database creation and selection-Database table creation, update table structure-insert, update, delete data to a table-Fetch data from table, Acquiring the value, Joins, sub query-Finding the number of rows-Executing multiple queries- Cookies -The anatomy of a cookie-Setting a cookie with PHP-Deleting a cookie-Creating session cookie-Working with the query string-Creating query string.	9	CO4
5	UNIT-V: Session -What is session-Starting a session-Working with session variables -Destroying session-Passing session Ids-Encoding and decoding session variables Disk Access, I/O, And Mail -File upload-File download-Environment variables-E-mail in PHP-Random numbers AJAX (Asynchronous JavaScript and XML)-Introduction to AJAX-Introduction to XMLHttpRequest Object-Method and Properties of XMLHttpRequest-Application of AJAX in web application	9	CO5, CO6

TEXT BOOKS:

1. David Sklar, Nathan Torkington (2004). *Learning PHP* (5th edition), O'Reilly publishers.
2. W. Jason Gilmore (2006). *Beginning PHP and MySQL 5 From Novice to Professional*, Apress.
3. Kevin Yank (2009). *Build Your Own Database Driven Web Site Using PHP & MySQL*, Sitepoint.

REFERENCE BOOKS:

1. Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre (2006). *Programming PHP*, O'Reilly publishers.
2. Luke Welling, Laura Thomson, (2004). *PHP and MySQL Web Development* (3rd Edition), Sams publishers.

E- REFERENCES:

1. https://www.wired.com/2010/02/php_tutorial_for_beginners/

2. <http://php.net/manual/en/tutorial.firstpage.php>
3. <http://php.happycodings.com/>
4. <https://www.codingunit.com/php-tutorial-language-introduction>
5. http://www.spoken_tutorial.org

Course Title: OBJECT ORIENTED SOFTWARE ENGINEERING

Course Code:	Credits	: 03
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking the course, the students will be able to Develop the knowledge and practical skills needed to successfully participate in the analysis, design and development of large software systems, using object-oriented approaches, they can Apply team dynamics by working in teams, Focus on object-oriented approaches and project management techniques Communicate the science and Development of graphical user interfaces, and quality assurance.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Knows the reason about the basic Software life cycle models Importance of various kinds of Project Management methods, Tracking Software Quality, Quality Standards and Metrics.
CO2	Develop System Concepts for Object Modelling Design and implement a software design concepts to meet desired needs and

	Requirements. Design the UML concepts like sequential, Use cases and Activity diagram
CO3	Concepts of Use cases, actors, and common modelling techniques. Implement the concept use cases, business actors , Significance of identifying the subsystems and business requirements
CO4	Explain Design Workflow and System Design Concept Create Mapping Object Model to Database Schema Testing and verification process
CO5	Usage of Software Configuration Management Define maintenance and its types. Build Reverse and re-engineering process.
CO6	Create projects using tools of software engineering and techniques.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	3	3	2	2	2	3	2
CO 2	3	3	2	3	3	3	3	3	2	3	3	3	3
CO 3	3	3	2	3	3	3	3	3	2	3	3	3	3
CO 4	3	3	2	3	3	3	3	3	2	3	3	3	3
CO 5	3	3	2	2	2	2	3	3	2	3	2	3	2
CO 6	3	3	2	3	3	2	3	3	2	3	2	3	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	Software life cycle models: Waterfall, RAD, and Spiral model Process metric – Product metrics – Estimation – LOC, FP, COCOMO models – Project Management – Planning, Scheduling and Tracking Software Quality – Quality Standards, Quality Metrics.	10	CO1
2	System Concepts for Object Modeling – Abstraction, Inheritance, Polymorphism, Encapsulation, Message Sending, Association, Aggregation – Requirement Workflow Functional, Non-functional – Characteristics of Requirements – Requirement Elicitation Techniques – Requirement Documentation – Use case specification, Activity Diagram.	10	CO2
3	Use-Case Modeling – Actors, Use Cases, Use Case Relationships. The Process of Requirements Use-Case – Identify Business Actors, Identify Business Requirements, Use Cases, Construct, Use Case Model Diagram – Class Diagrams and Object Diagrams – Package Diagrams – Sequence and Collaboration diagrams, State chart diagram.	10	CO3

4	Design Workflow: System Design Concept – Coupling and Cohesion – Architectural Styles – Identifying Subsystems and Interfaces – Design Patterns Implementation Workflow – Mapping models to Code – Mapping Object Model to Database Schema Testing – Formal Technical Reviews – Walkthrough and Inspection.	5	CO4
5	Software Configuration Management – Managing and controlling Changes – Managing and controlling versions Maintenance – Types of maintenance – Maintenance Log and defect reports – Reverse and re-engineering.	5	CO5, CO6

TEXT BOOKS:

1. Roger Pressman, (2005). *Software Engineering*, (Sixth Edition), TMH. ISBN no: 13:978-007-126782-3.
2. Bahrami, (2008). *Object Oriented Systems Development*, (Second edition), TMH. ISBNno: 13 978-0070265127.
3. Bernd Bruegge, (2004). *Object oriented software engineering*, (Second Edition), Pearson Education. ISBN no: 13 978-93332518681.

REFERENCE BOOKS:

1. Stephan R Schach, (2007). *Object oriented software engineering*, (Second edition), TMH. ISBN no: 9780071259415
2. Timothy C Lethbridge, Robert Laganier (2004). *Object-Oriented Software Engineering Practical software development using UML and Java*, (Second edition), TMH.

E- REFERENCES:

1. www.enginumdumich.edu/CIS/coursedes/cis200/tutorial/onedoc
2. www.nptel.iitm.ac.in/courses/Webcourse-contents/IISc/LNm9.pdf
3. www.niecdelhi.ac.in/uploads/Notes/btech/6sem/.../oose lecture plan.pdf
4. <https://vabringreaba.cf/f0o4tuHDIKGa5C.php>
5. <https://www.edutechlearners.com/oose-notes/>

Course Title: UNIFIED MODELING LANGUAGE

Course Code:	Credits	: 03
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking the course, the students will be able to understand the importance of various basic concepts of object modeling Gain the knowledge about various basic structural modeling along with their applicability contexts. The students can Analyze various basic Behavioral modeling of object-oriented software design (UML) and review the concepts of Advance Behavioral modeling.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Analyse the basic concepts of object modeling.
CO2	Demonstrate various Basic Structural Modeling using the appropriate notation
CO3	Demonstrate various Basic Behavioral Modeling using the appropriate notation
CO4	Analyse various Advanced Behavioral Modeling using the appropriate notation
CO5	Analyse Architectural Modeling using the appropriate notation

CO6	Apply various uml diagrams for software development.
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Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	2	2	2	2	2	2	1	3	2	2	2	2
CO 2	3	3	2	2	3	1	3	3	1	3	3	3	2
CO 3	3	2	2	2	3	2	3	3	2	3	2	3	2
CO 4	2	3	2	2	2	2	2	2	2	2	2	2	3
CO 5	3	3	2	2	3	2	2	3	2	3	3	3	3
CO 6	2	2	2	3	3	3	3	3	2	2	3	2	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture	9	CO1
2	Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Interfaces, Types and Roles, Packages. Class & Object Diagrams: Terms, Concepts, modeling techniques for Class & Object Diagrams.	9	CO2
3	Basic Behavioral Modeling: Interactions, Interaction diagrams. Use cases, Use case Diagrams, Activity Diagrams.	9	CO3
4	Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.	9	CO4
5	Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.	9	CO5, CO6

TEXT BOOKS:

- Grady Booch, James Rumbaugh, Ivar Jacobson (2005). *The Unified Modeling Language User Guide*, (Second Edition), Pearson Education, ISBN no:0-201-57168-4
- Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado (2003). *UML Toolkit*, (Second Edition), WILEY-Dreamtech India Pvt. Ltd, ISBN no:13:978-81-265-0466-4
- Grady Booch (2007). *Object Oriented Analysis and Design*, (Third Edition), Addison Wesley, ISBN no :0-8053-5340-2

REFERENCE BOOKS:

1. Pascal Roques, Modeling (2007). *Software Systems Using UML2*, (Fourth Edition), WILEY-Dreamtech India Pvt. Ltd. ISBN no :13-978-81-265-0505-0
2. AtulKahate, (2000). *Object Oriented Analysis & Design*, Tata McGraw-Hill. ISBN no: 0-07-058376-5
3. Ali Bahrami, (1999). *Object Oriented Systems Development*, McGraw Hill. ISBN no:13-978-0-07-026512-7

E- REFERENCES:

1. www.uml-tutorials.trireme.com
2. www.smartdraw.com/resources/tutorials/uml-diagrams

Course Title: OBJECT ORIENTED ANALYSIS AND DESIGN

Course Code:	Credits	: 03
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking the course, the students will be able to understand the concept of object-oriented development, and create a static object model and a dynamic behavioral model and a functional model of the system. They can easily understand the approaches to system design and object design, and the techniques of translating design to implementation.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Analyze object basics and UML.
CO2	Gain knowledge about attributes and relationship.
CO3	Interpret axioms and do a case study.
CO4	Detailed study about Micro level process.
CO5	Digital signatures.

CO6	Gain knowledge about various testing strategies.
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Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	2	2	2	2	2	2	3	3	2	2	2	2
CO 2	3	3	2	2	3	1	3	3	1	3	3	3	2
CO 3	3	2	2	2	3	2	3	3	2	3	2	3	2
CO 4	2	3	2	2	2	2	2	2	2	2	2	2	3
CO 5	3	3	2	2	3	2	2	3	2	3	3	3	3
CO 6	2	2	2	3	3	3	2	2	2	2	3	2	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	System development - object basics - development life cycle - methodologies - patterns - frameworks - unified approach - UML.	10	CO1
2	Use Case models - object analysis - object relations - attributes - methods, class and object responsibilities - case studies	10	CO2
3	Design processes - design axioms - class design - object storage - object interoperability - case studies.	10	CO3
4	User interface design - view layer classes - micro - level processes - view layer interface - case studies.	10	CO4
5	Quality assurance tests - testing strategies - object orientation on testing - test cases - test plans.	5	CO5

TEXT BOOKS:

1. Ali Bahrami, (1999). *Object Oriented Systems Development*, McGraw Hill. ISBN no:13-978-0-07-026512-7
2. Grady Booch (2007). *Object Oriented Analysis and Design*, (Third Edition), Addison Wesley, ISBN no :0-8053-5340-2
3. Bernd Bruegge, (2004). *Object oriented software engineering*, (Second Edition), Pearson Education. ISBN no: 13 978-93332518681.

REFERENCE BOOKS:

1. James Rumbaugh, Michael R. Blaha, (2004). *Object-Oriented Modeling and Design with UML* , (Second Edition),Prentice Hall ISBN no: 978-81-317-1106-4
2. AtulKahate, (2000). *Object Oriented Analysis &Design*, Tata McGraw-Hill. ISBN no: 0-07-058376-5
3. Roger Pressman, (2005). *Software Engineering*, (Sixth Edition), TMH. ISBN no: 13:978-007-126782-3.

E- REFERENCES:

1. <http://www.exforsys.com/tutorials/ooad/ooad-introduction.html>
2. <http://www.devshed.com/c/a/Practices/Introducing-UMLObjectOriented-Analysis-and-Design>

Course Title: PRACTICAL I - PYTHON PROGRAMMING LAB

Course Code:	Credits	: 02
L:T:P:S : 0:0:5:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course, student will be able to interpret the programming language and implement the various programs in handling data, strings, files, graphics, and data exploration.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Interpret the programming task logically and make the pseudo code.
CO2	Understand the IDE and write, execute and debug.
CO3	Implement the basic string functions.
CO4	Apply the concept of pygtk.
CO5	Understand the concept of interpret data exploration and data munging.
CO6	Understand and apply the knowledge on data science.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5

CO 1	3	1	1	3	1	3	1	1	3	3	2	2	3
CO 2	3	2	2	2	2	1	1	1	3	2	2	2	3
CO 3	3	2	2	2	2	1	1	1	3	3	3	3	2
CO 4	3	2	2	2	1	1	1	2	3	2	2	3	3
CO 5	3	3	2	2	2	2	1	1	3	3	3	3	2
CO 6	3	3	2	2	2	2	2	1	3	3	3	3	1

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	a) Simple calculator to do all the arithmetic operations. b) Programs to use control flow tools like if. c) Programs to use for loop.	5	CO1
2	a) Data structures <ul style="list-style-type: none"> ● Use list as stack ● Use list as queue ● Tuple, sequence b) New module for mathematical operations and use in your program. c) Programs to read and write files, create and delete directories.	5	CO2
3	a) Programs with exception handling. b) Programs using classes and objects. c) Connect with MYSQL and create an address book and do the operations. <ul style="list-style-type: none"> ● Insert, read, update and delete 	7	CO3
4	a) GUI program using PYGTK. b) programs Using Numpy. c) Programs Using scipy.	8	CO4
5	a) Programs using series and data frames. b) Programs using charts/graphs.	10	CO5

6	a) Programs using statistics. b) Programs for data exploration.	10	CO6
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Course Title: PRACTICAL II - PHP PROGRAMMING LAB

Course Code:	Credits	: 02
L:T:P:S : 0:0:5:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course the student will be able to develop simple applications using control flow and loops, create arrays and perform various array functions ,to create files and perform file access operations, develop applications using object oriented concepts, to create database using MySQL and connect to the PHP, to develop Cookies and Sessions in PHP and to acquire knowledge about designing Forms using Get and Post method.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Develop application using Control structures and Looping statements.
CO2	Develop application using array functions, string functions, date functions.
CO3	Develop applications using user defined functions and file operations
CO4	Build and develop application using Cookies and Session management.
CO5	Build and implement applications using object oriented programming concept.
CO6	Design database connection application using MYSQL

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 2	3	3	3	3	3	3	2	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	3	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	3	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	Create applications using Control Structures such as if-statement, if-else, if-else if, nested if, Switch statement. Built applications using Looping statements such as For, While, Do- while, Foreach statement.	9	CO1
2	Create applications using array – creating, sorting, merging. Develop programs using String functions and Date functions	9	CO2
3	Create application using File System-Creating and deleting a file-Reading and writing text files. File upload-Checking for existence of file-Determining file size. Developing programs using built in and user defined functions.	9	CO3
4	Create applications using Forms – communication between HTML and PHP server. Redirecting Forms, Checking hidden fields and Form Validation. Develop applications using cookies and session management.	9	CO4
5	Develop applications using Object Oriented Programming such as constructors and destructors, Class inheritance, Abstract classes and methods, Object serialization. Design database connection applications using MYSQL.	9	CO5, CO6

Course Title: SPOKEN TUTORIAL - PYTHON

S.No	CONTENTS OF MODULE
1	Getting started with python – Using the plot command interactively – Embellishing a plot – Saving plots – Multiple plots – Additional features of Python – loading data from files – Plotting the data – Other types of plots – Getting started with sage notebook – Getting started with symbolic – Using Sage – Using sage to teach – Getting started with lists – Getting started with for – Getting started with strings – Getting started with files – Parsing data – Statistics – Getting started with arrays – Accessing parts of arrays – Matrices – Least square fit – Basic data types and operators – I/O – conditionals – Loops – Manipulating lists – Manipulating strings – Getting started with tuples – Dictionaries – Sets – Getting started with functions – Advanced features of functions – Using python modules – Writing python scripts – Testing and debugging

Note:

Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.

SECOND SEMESTER (SYLLABUS)

Course Title: DIGITAL IMAGE PROCESSING		
Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course, student will be able to understand digital image processing fundamentals, to compare and contrast the classification of image Enhancement techniques in detail, to identify and analyze the concepts of image restoration and degradation, to get good understanding of image segmentation and image compression techniques, to apply the knowledge in research.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Describe the fundamentals of image processing and its applications.
CO2	Gain adequate knowledge of Image enhancement techniques in spatial domain
CO3	Detailed classification of Image enhancement techniques in frequency domain and compare with spatial domain techniques
CO4	Analyze the Image restoration and degradation concepts Identify the fundamentals techniques in image segmentation
CO5	Acquire a good knowledge of Image compression techniques
CO6	Interpret Image segmentation, restoration and compression techniques

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5

CO 1	3	2	2	2	3	3	2	3	3	2	2	2	3
CO 2	3	2	3	3	2	3	2	3	2	3	2	3	3
CO 3	3	2	2	3	2	3	2	3	3	3	2	3	3
CO 4	3	2	3	2	2	3	2	3	3	3	2	3	2
CO 5	3	2	2	3	2	3	2	3	3	3	2	2	2
CO 6	3	3	3	2	3	3	3	3	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: Introduction – steps in image processing, Image acquisition, representation, sampling and quantization, relationship between pixels – color models – basics of color image processing.	9	CO1
2	UNIT II: Image enhancement in spatial domain – some basic gray level transformations – histogram processing – enhancement using arithmetic, logic operations – basics of spatial filtering and smoothing	9	CO2
3	UNIT III: Image enhancement in Frequency domain – Introduction to Fourier transform: 1-D, 2-D DFT and its inverse transform, smoothing frequency domain filters – Ideal low pass filters, Butterworth Low-pass filter, Gaussian Low-pass filters sharpening frequency domain filters – Ideal High pass filter, Butterworth high pass filter, Gaussian High Pass filter	9	CO3
4	UNIT IV: Image restoration : Model of degradation and restoration process – noise models – restoration in the presence of noise – periodic noise reduction. Image segmentation: Thresholding and region based segmentation.	9	CO4
5	UNIT V: Image compression : Fundamentals – models – error free compression – Lossy compression : Lossy predictive coding, Transform coding, Wavelet coding.	9	CO5, CO6

TEXT BOOKS:

1. RC Gonzalez, RE Woods (2002). *Digital Image processing* (2nd Edition), Pearson Education, ISBN 0201180758
2. RC Gonzalez (2009). *Digital Image Processing using MATLAB* (3rd edition), GP Publishers, ISBN 978-0070702622
3. Maria Petrou, Costas Petrou (2010). *Image Processing: The Fundamentals* (2nd edition), Wiley, ISBN 978-0470745861

REFERENCE BOOKS:

1. Chris Solomon. *Fundamentals of Digital Image Processing* (1st edition), Wiley, ISBN 978-

CO 2	3	3	3	3	3	2	3	3	3	3	2	3
CO 3	3	3	3	3	3	2	3	3	3	3	2	3
CO 4	3	2	2	3	3	2	2	2	3	2	2	3
CO 5	3	2	2	3	3	3	2	2	3	2	2	3
CO 6	3	3	3	3	3	3	3	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: Database System Concepts And Architectures: Data Models – Schemas – Instances – Three Schema Architecture – Data Independence – Database Languages. E-R Model and EER Model: Entity Types – Entity Sets – Attributes – Key – Relationship Types – Relationship Sets – Weak Entity Types – ER Diagram – Naming Conventions – Subclasses – Super classes – Inheritance – Specialization And Generalization – Constraints and Characteristics Of Specialization and Generalization Hierarchies.	9	CO1,CO2
2	UNIT II: Normalization: Basic Definitions – Functional Dependencies – Types of FD – Introduction to Normalization – Decomposition – Dependency Preservation – First, Second, Third Normal Forms – BCNF – Multivalued Dependencies and Fourth Normal Form – Join Dependency and Fifth Normal Form.	10	CO3
3	UNIT III: Object And Object Relational Databases – Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects Object Database Standards and Languages: Overview of ODMG Model – ODL – OQL .	8	CO4
4	UNIT IV Data Warehousing And Distributed DBMS – Data Warehousing – Characteristics Of Data Warehouses – Data Modeling For Data Warehouses – Typical Functionality Of A Data Warehouse – Distributed DBMS – Features – Factors Encouraging DDBMS – Advantages Of Distributed Data Bases – Distributed DBMS Architecture – Types Of Distributed Data Bases.	9	CO5
5	UNIT V: Emerging Technologies – Mobile Databases – Architecture and Data Management Issues – Multimedia Databases – Nature of Data, Data Management Issues and Applications.	9	CO6

TEXT BOOKS:

1. R Elmasri, SB Navathe (2007). *Fundamentals of Database Systems* (5th Edition), Pearson Education/Addison Wesley.

REFERENCE BOOKS:

1. Henry F Korth, Abraham Silberschatz, S Sudharshan (2006). *Database System Concepts* (5th Edition), TMH.
2. CJ Date, A Kannan and S Swamynathan (2006). *An Introduction to Database Systems* (8th Edition), Pearson Education.

E- REFERENCES:

1. www.cse.iitb.ac.in/dbms/Data/Courses/CS632/
2. www.nptel.iitm.ac.in/video.php?subjectId=106106093
3. www.tutorialspoint.com/distributed_dbms/distributed_dbms_tutorial.pdf

Course Title: ENTERPRISE COMPUTING

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course, student will be able to understand the various concepts of Enterprise programming, developing RMI Application, Servlet and session management and learn data manipulation using JDBC, develop web applications using JSP, implement Javamail API and familiarize the students with the concepts of reusable classes using JavaBeans, Hibernate and Spring Framework applications.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand various concepts of Enterprise programming, analyze and implement the RMI Architecture for the necessary applications.
CO2	Implement Session management using Servlet and implement JDBC for the database connectivity.
CO3	Develop Web applications using JSP and JSP error pages.
CO4	Design an application that sends and receives email with attachments.
CO5	Implement Database connectivity through Hibernate Framework and also build web applications using Spring MVC.
CO6	Study and use modern tools for rapidly building enterprise applications.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	2	3	3	2	2	2	3	3	3	2	3
CO 2	3	3	2	3	3	2	2	2	2	3	3	3	3

CO 3	2	3	2	2	3	2	3	3	2	3	3	2	3
CO 4	3	3	2	3	3	2	2	2	2	3	2	3	2
CO 5	2	3	3	3	3	3	3	3	3	3	2	3	3
CO 6	3	3	3	3	3	3	3	3	3	2	3	2	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	Need for Enterprise Programming – J2EE Advantage – Enterprise Architecture types– Architecture of J2EE – J2EE Components – J2EE Containers – Introducing RMI – RMI Architecture – Application Development with RMI – RMI over IIOP.	9	CO1
2	Introduction to Servlets – Servlet Life Cycle – Servlet API Basics – HTTP Redirects –Cookies –State and Session Management –Hidden Fields – URL rewriting –Session Management with the Servlet API – Inter Servlet Communication – Server Side Includes and Request Forwarding –Data Base Access with JDBC.	9	CO2
3	JSP : Introduction JSP –Examining MVC and JSP –JSP scripting elements &directives –Working with variables scopes –Error Pages – using Java Beans in JSP.	6	CO3
4	Javamail: Working with Java Mail –Understanding Protocols for Javamail –Components –Javamail API –Understanding Java Messaging Services: JMS Components EJB Fundamentals – EJB Architecture – EJB Roles –Introduction to Session Beans, Entity Beans & Message Driven Beans.	9	CO4
5	Hibernate : Overview of Hibernate, Hibernate Architecture, Hibernate Mapping Types, Hibernate O/R Mapping, Hibernate Annotation, Hibernate Query Language – Spring MVC –Overview of Spring, Spring Architecture, bean life cycle, XML Configuration on Spring, Aspect – oriented Spring, Managing Database, and Managing Transaction.	12	CO5, CO6

TEXT BOOKS:

1. Jason hunter, William Crawford (2001). *Java Server Programming* (2nd Edition), O'Reilly Media, Inc., ISBN: 9780596000400.
2. J McGovern, R Adatia, Y Fain (2003). *J2EE 14 Bible*, Wiley-dreamtech India Pvt Ltd.
3. James Holmes, Herbert Schildt (2000). *Struts: The complete Reference* (2nd Edition), TMH.
4. H.Schildt (2002). *Java 2 Complete Reference* (5th Edition), TMH.

REFERENCE BOOKS:

1. K Moss (1999). *Java Servlets* (Second Edition), TMH.
2. Joseph O'Neil (1998) *Java Beans from the Ground Up*, TMH.
3. TomValesky (2000) *Enterprise JavaBeans*, Addison Wesley.
4. Cay S Horstmann & Gary Cornell (2002). *Core Java Vol II Advanced Features* (8thEdition), Addison Wesley.

E- REFERENCES:

1. <https://www.tutorialspoint.com/servlets/servlets-first-example.htm>
2. <http://www.servlets.com/jservlet2/examples/>
3. http://www.j2eetutorials.50webs.com/JSP_example1.html
4. <http://www.javatpoint.com/ejb-tutorial>
5. <https://slideplayer.com/slide/7362666/>

Course Title: DATAWAREHOUSING AND DATAMINING

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course the student will be able to understand and implement classical models and algorithms in data warehousing and data mining, analyze the data, identify the problems, and choose the relevant algorithms for the chosen dataset, compare and contrast different conceptions of data mining, to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Appreciate the basic principles, concepts and applications of data warehousing and data mining
CO2	Have a good knowledge of the preprocessing techniques
CO3	Perform Data Mining using association rules
CO4	Get insights from data using classification and prediction techniques
CO5	Acquire knowledge of clustering techniques and outliers
CO6	Apply data mining techniques to real world data by cleaning the data, integrating the data from different sources, predicting a model to group the data tuples into classes, discovering patterns using association rule mining and grouping the data set into clusters.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	3	3

CO 2	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 4	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: Introduction to data warehousing – OLAP – Data Mining tasks – Data Mining versus Knowledge Discovery in Data bases – Mining Issues – Metrics – Social implications of Data mining Data Mining Techniques – Introduction – A statistical perspective on Data Mining – similarity measures – Decision Trees – Neural Networks – Genetic Algorithms.	9	CO1
2	UNIT II: Data Preprocessing: Why preprocess the data – Data cleaning – Data Integration – Data Transformation – Data Reduction – Data Discretization.	9	CO2
3	UNIT III: Data Mining Techniques: Association Rule Mining – The Apriori Algorithm – Multilevel Association Rules – Multidimensional Association Rules – Constraint Based Association Mining.	9	CO3
4	UNIT IV: Classification and Prediction: Issues regarding Classification and Prediction – Decision Tree induction – Bayesian Classification – Back Propagation – Classification Methods – Prediction – Classifiers accuracy.	9	CO4, CO6
5	UNIT V: Clustering Techniques: cluster Analysis – Clustering Methods – Similarity and Distance Measures – Hierarchical Methods – Partitional Methods – Outlier Analysis.	9	CO5, CO6

TEXT BOOKS:

1. Jiawei Han, MichelineKamber, Jian Pei (2008). *Data Mining: Concepts and Techniques* (2nd edition), Morgan Kaufmann, ISBN- 9780123814791

REFERENCE BOOKS:

1. B Forouzan (1998). *Introduction to Data Communications in Networking*, Tata McGraw Hill.
2. Halsall (1995), *Data Communications, Computer Networks and Open Systems* (20th edition), Addison Wesley.

E- REFERENCES:

1. www.technolamp.co.in/2010/08/computer-networks-tanenbaum-powerpoint.html
2. <https://www.ece.rutgers.edu/~marsic/books/CN/>

Course Title: MOBILE COMMUNICATIONS

Course Code:	Credits	: 03
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course the student will be able to explain the basics of wireless communication systems, multiplexing and compare the various cellular systems and its components, Describe the concepts of Telecommunication systems and Satellite systems, Discuss about Wireless LAN and Bluetooth technology, Gain core knowledge of mobile network layer such as Packet delivery, tunneling and routing Strategies and Discuss the transport layer congestion control, snooping and TCP protocols.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Gain a detailed knowledge of Wireless Networking concepts. Analyse and compare the various cellular systems and its components.
CO2	Analyse the concepts of Telecommunication networks and illustrate the sessions and Protocols. Demonstrate the working of satellite systems.
CO3	Analyse various wireless techniques in wireless LAN and implement it into user environment.
CO4	Identify and analyse the existing routing protocols. Describe how tunnelling works and analyse various protocols using tools for traffic less packet delivery.
CO5	Describe the transport layer congestion control and tcp protocols .Demonstrate the snooping technique and provide solutions to protect users data from unauthorized users.
CO6	Compare various Wireless application protocols and techniques to choose the best protocol for developing mobile content applications using modern tools for multidisciplinary environments.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	2	2

CO 2	3	3	3	3	3	3	2	2	3	3	3	2	2
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	2
CO 4	3	3	3	3	3	3	2	2	3	3	3	3	2
CO 5	3	3	3	3	3	3	2	2	3	3	3	3	2
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: Introduction – Mobile and Wireless Devices – Simplified Reference Model – Need for Mobile Computing –Wireless Transmissions – Multiplexing – Spread Spectrum and Cellular Systems – Medium Access Control – Comparisons.	9	CO1
2	UNIT II: Telecommunication Systems – GSM – Architecture – Sessions –Protocols – Hand Over and Security – UMTS and IMT – 2000 – Satellite Systems.	9	CO2
3	UNIT III: Wireless Lan – IEEE S0211 – Hiper LAN – Bluetooth – Security and Link Management.	9	CO3
4	UNIT IV: Mobile network layer – Mobile IP – Goals – Packet Delivery – Strategies – Registration – Tunneling and Reverse Tunneling – Adhoc Networks – Routing Strategies.	9	CO4
5	UNIT V: Mobile transport layer – Congestion Control – Implication of TCP Improvement – Mobility – Indirect – Snooping – Mobile – Transaction oriented TCP – TCP over wireless – Performance.	9	CO5, CO6

TEXT BOOKS:

1. J Schiller (2003), *Mobile Communications* (2nd Edition), Pearson Education, ISBN- 978-8131724262.

REFERENCE BOOKS:

1. Hansmann, Merk, Nicklous, Stober (2004). *Principles of Mobile Computing* (2nd Edition), Springer publishers.
2. Pahlavan, Krishnamurthy (2003). *Principle of wireless Networks: A unified Approach*, Pearson Education.
3. W Stallings (2004), *Wireless Communications and Networks* (2nd Edition), Pearson Education, Delhi.

E- REFERENCES:

1. www.nptel.iitm.ac.in/video.php?subjectId=117102062

2. <https://www.iith.ac.in/~tbr/teaching/lectures.html>
3. https://www.mi.fuberlin.de/inf/groups/agtech/teaching/resources/Mobile_Communications/course_Material/C01-Introduction.pdf
4. https://www.tutorialspoint.com/umts/umts_history_of_mobile_communication.htm

Course Title: HIGH SPEED NETWORKS

Course Code:	Credits : 03
L:T:P:S : 4:0:0:0	CIA Marks : 40
Exam Hours: 03	ESE Marks : 60

LEARNING OBJECTIVES:

On taking this course the student will be able to Understand evolution of communication and networking, also to enhance future networks and principles of operation, Provide the various high speed digital access and broadband technologies, Performance issues and quality of service required for better performance of high speed networks, Develop an in-depth understanding, in terms of architecture, protocols and applications, of major high- speed networking technologies and Discusses logical, routing, Addressing, addressing, protocols and about ATM.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Identify the existing communication networks, understand the algorithm and technologies involved in internet and associated networks.
CO2	Develop specialized knowledge related to the building blocks and operation of high speed networking technology.
CO3	Demonstrate the knowledge of network planning and optimization
CO4	Apply the concepts to optimize and troubleshoot high speed network.
CO5	Use and assist in network design and implementation.
CO6	Select the ATM over other available transfer modes in network designs

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	2	2
CO 2	3	3	3	3	3	3	2	2	3	3	3	2	2

CO 3	3	3	3	3	3	3	2	2	3	3	3	2	2
CO 4	3	3	3	3	3	3	2	2	3	3	3	2	2
CO 5	3	3	3	3	3	3	2	2	3	3	3	3	2
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: High Speed Networks Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fibre Channel – Wireless LAN's: applications, requirements – Architecture of 802.11	9	CO1
2	UNIT II: Congestion And Traffic Management Queuing Analysis – Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.	99	CO2
3	UNIT III: TCP And ATM Congestion Control TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.	9	CO3
4	UNIT IV: Integrated And Differentiated Services: Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRfq, GPS, WFQ – Random Early Detection, Differentiated Services.	9	CO4, CO6
5	UNIT V: Protocols For Qos Support – RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.	9	CO5, CO6

TEXT BOOKS:

1. William Stallings (2002). *High Speed Networks and Internet* (2nd Edition), Pearson Education, ISBN-

978-8177585698.

REFERENCE BOOKS:

1. Warland, Pravin Varaiya (2001). *High Performance Communication Networks* (2nd Edition), Jean Harcourt Asia Pvt Ltd.
2. Irvan Pepelnjk, Jim Guichard and Jeff Aparcar (2003). *MPLS and VPN Architecture*, Cisco Press.

E- REFERENCES:

1. <http://www.sterbenz.org/jpgs/tutorials/hsn/>
2. <https://www.slideshare.net/ayyakathir/unit1-29753217>
3. <http://pages.cpsc.ucalgary.ca/~carey/CPSC641/archive/Sept2005/>

Course Title: WAP and XML

Course Code:	Credits	: 03
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking the course, the students will be able to exhibit the knowledge of wireless application protocol (WAP) and WAP Gateways And they can derive the basic scripts of WML and style sheets to attain the cognizance of Wireless Scripting languages and Implement the XML Schema for acquiring the knowledge of user databases, to study the concepts of XML XSLT applications.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Develop knowledge of basic wireless environment, Wireless applications protocol.
CO2	Have a good knowledge of WAP gateway and their functionalities.
CO3	Construct the Wireless Markup Language and its applications.
CO4	Gain the knowledge of XML applications and Preparing style sheets.
CO5	Implementation of XSLT.
CO6	Compare accepted standards and guidelines to select appropriate applications of XML to meet specified performance requirements.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	2	2	2	2	3	3	3	3	3	3	2
CO 2	3	3	2	3	3	2	2	2	2	2	3	2	2
CO 3	3	3	2	3	3	3	2	2	3	3	3	2	2

CO 4	3	3	2	3	3	3	2	2	3	3	3	2	3
CO 5	3	3	2	3	3	3	2	2	3	3	3	3	2
CO 6	3	3	2	3	3	3	2	2	2	3	3	3	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	Overview of WAP : WAP and the wireless World – WAP Application Architecture – WAP Internal Structure – WAP Versus the Web – WAP resources – The Development Tool Kits.	9	CO1
2	WAP gateways: Definition – Functionality of a WAP gateway – The Web model Versus the WAP Model – Positioning of a WAP gateway in the Network – Selecting a WAP Gateway – BASIC WML : eXtensible Markup Language – WML structure – A Basic WML Card – Text formatting – Navigation – Advanced Display Features.	9	CO2
3	Interacting with the user: Making a selection – Events Variables – Input parameter passing – WML script – Need for WML script – lexical structure – Variable & literals – Operators – Automatic data type conversion – Control Constructs – Functions – Using the standard Libraries – Programs – Dealing with errors.	9	CO3
4	XML introduction – XML life cycle – XML tree – XML syntax – elements – attributes – XML tags – XML Parser – X query – X Path – Link – DTD – XML schema- Applications of XML – XML for XML – XML Examples – Preparing a style sheet for Document Display.	9	CO4
5	XSLT : introduction – XSL language – XSLT Transform – XSLT <template> – XSLT<value of> – XSLT<For each> - XSLT<if> – XSLT<sort> – XSLT<choose> – XSLT edit XML – XSLT examples.	9	CO5, CO6

TEXT BOOKS:

1. Charles Arehart et. al (2000). *Professional WAP with WML, WML, WML script, ASP, JSP, XML, XSLT, WTA, Push and Voice XML*, Shroff Publishers and Distributors Pvt Ltd., ISBN no :1-861004-0-44.
2. Elliotte Rusty Harold (2003). *XML™ Bible* (Third Edition), IDG Books India (P) Ltd., ISBN no:0-7645-4986-3.

REFERENCE BOOKS:

1. David Hunter, Jeff Rafter, Joe Fawcett, Andrew Watt, Linda McKinnon (2007). *Beginning XML*, (Fourth Edition), Wrox Press publishers. ISBN:978-0764570773.
2. P Nicopolitidis, Mohammad S Obaidat, Georgios I Papadimitriou(2003). *Wireless Networks*, Wiley publishers, ISBN:978-0470845295.

E- REFERENCES:

1. <http://www.roseindia.net/wap/index.shtml>
2. <https://www.w3schools.com/xml/default.asp>
3. http://www.tutorialspoint.com/xml/xml_tutorial.pdf
4. <http://www.spoken-tutorials.org>

Course Title: PRACTICAL III - ENTERPRISE COMPUTING LAB

Course Code:	Credits	: 02
L:T:P:S : 0:0:5:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course, student will be able to equip the students with the advanced feature of contemporary java, to enable them in handling complex programs relating to managing data and processes over the network, to provide a sound foundation on the concepts, precepts and practices, in a field that is of immense concern to the industry and business.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Invoke the remote methods in an application using Remote Method Invocation, Access database through Java programs, using Java Data Base Connectivity.
CO2	Manage sessions within an application and communication between sessions.
CO3	Implement and manage web sessions using Servlet and JSP. Handling Errors and Exceptions in any web application
CO4	Understanding Java Messaging Services done through javamail API.
CO5	Develop applications with hibernate framework.
CO6	Develop spring applications with spring framework.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	2	3	2	3	3	3	3	2	3	3	3
CO 2	3	2	2	2	3	2	3	3	2	3	2	2	2
CO 3	3	2	2	3	2	2	3	3	3	3	2	3	2
CO 4	3	2	3	2	3	2	3	2	3	2	2	3	3

CO 5	3	3	3	3	2	3	3	3	3	2	3	3	3
CO 6	3	3	3	3	2	3	3	3	3	2	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	a) Develop an RMI Application for arithmetic operations b) Simple Servlet Application with login page.	5	CO1
2	a) Design Web application using HTML and java servlet for session tracking and management using cookies, Hidden form field, URL rewriting, HTTP session. b) Display session details of any web application.	9	CO2
3	a) Implementation of JSP: student scoring system b) Implement exception handling using Error pages in JSP. c) Design web page using JSP and implement the concept of Java Bean in JSP d) Design web page using HTML and java servlet pages for the implementation of inter servlet communication using Request Dispatcher. e) MYSQL database connectivity using JDBC.	6	CO3
4	a) Design a web page with options for sending email using Javamail API.	7	CO4
5	a) Implementation of database manipulation using ORM Mapping in Hibernate.	7	CO5
6	a) Design Simple application using spring framework. b) Web application for connecting database in spring.	11	CO6

Course Title: PRACTICAL IV - DATA MINING LAB USING PYTHON

Course Code:	Credits	: 02
L:T:P:S : 0:0:5:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course the student will be able to create a DataFrame, load a dataset and perform data cleaning

operations, to integrate data from different sources, to select the relevant data and remove the irrelevant data, to perform classification using classification algorithms and apply clustering algorithms to cluster the data.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Perform Data Cleaning, Data Integration
CO2	Perform Data Transformation
CO3	Remove Outliers
CO4	Perform Association Mining
CO5	Do Classification using Classification algorithms
CO6	Perform Clustering using Clustering algorithms

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 2	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 4	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S. No	CONTENTS OF MODULE	Hrs	COs
1	Data Preprocessing and Data Integration	9	CO1
2	Programs using Min max Normalization, Zscore Normalization	9	CO2
3	Programs to remove Outliers	9	CO3

4	Programs using Association Mining	9	CO4
5	Programs using Naïve Bayes Classification, Decision Tree Classification, Clustering using Kmeans and Agglomerative.	9	CO5, CO6

Course Title: SPOKEN TUTORIAL - LINUX

S.No	CONTENTS OF MODULE
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1	Ubuntu Desktop- Desktop Customization- Synaptic Package Manager- Ubuntu Software Center- Basic Commands- General Purpose Utilities in Linux- File System- Working with Regular Files- File Attributes- Redirection Pipes- Working with Linux Process- The Linux Environment- Basics of System Administration- Simple filters- The grep command- More on grep command- The sed command- More on sed command- Basics of AWK.
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Note:

Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.

THIRD SEMESTER (SYLLABUS)

Course Title: SOFT COMPUTING

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40

LEARNING OBJECTIVES:

On taking this course the student will be able to gain a basic understanding of neural network theory and fuzzy logic theory, to identify different neural network architectures, algorithms, applications and their limitations, Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory, Analyze appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications, Develop the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic, Basic knowledge of Genetic algorithm and operators.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Gain basic knowledge of Artificial Neural Network, Fuzzy logic and Genetic algorithms
CO2	Analyse different neural network architectures
CO3	Get insight into classical sets and fuzzy sets
CO4	Develop the concepts of fuzzy relations and fuzzy propositions
CO5	Gain knowledge of Genetic algorithms and the various operators
CO6	Gain knowledge of various Algorithms

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	2	2	3	3	3	3	3	2
CO 2	3	2	3	3	3	3	3	3	3	2	3	3	3
CO 3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	3	3	3	2	3	3
CO 5	3	3	2	3	3	3	3	3	3	3	3	3	3
CO 6	3	2	3	3	3	3	3	3	2	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	Introduction: Neural Networks – Fuzzy Logic – Genetic Algorithms – Hybrid Systems. Artificial Neural Network – Fundamental Concept – Basic Models of Neural Network – Important Terminologies of	9	CO1

	ANN – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.		
2	Supervised Learning Network – Perceptron Networks – Adaptive Linear Neuron – Back-Propagation Network – Radial Basis Function Network. Associative Memory Networks : BiDirectional Associative Memory – Hopfield Networks.	9	CO2
3	Introduction to Classical Sets and Fuzzy Sets: Classical Sets – Fuzzy Sets. Classical Relations and fuzzy Relations: Cartesian Product of Relation – Classical Relation – Fuzzy Relations. Membership Functions: Features of the Membership functions – Fuzzification – Methods of Membership Value Assignments.	9	CO3
4	Defuzzification – Lamda – Cuts for Fuzzy sets and Fuzzy Relation – Fuzzy Arithmetic and Fuzzy Measures – Fuzzy Rule Base and Arithmetic Reasoning: Truth values and Tables in Fuzzy logic – Fuzzy Propositions – Formation of Rules – Decomposition and Aggregation of rules – Fuzzy reasoning – Fuzzy Inference Systems.	9	CO4
5	Genetic Algorithm -Introduction – Basic Operators and Terminologies in GAs – Traditional Algorithm vs. Genetic Algorithm – Simple GA – General Genetic Algorithm – The Scheme Theorem – Classification of Genetic Algorithm – Holland Classifier Systems – Genetic Programming.	9	CO5, CO6

TEXT BOOKS:

1. SN Sivanandan and SN Deepa (2007). *Principles of Soft Computing*, Wiley India.

REFERENCE BOOKS:

1. S Rajasekaran and GAV Pai (2003), *Neural Networks, Fuzzy Logic and Genetic Algorithms*, PHI.
2. Timothy J Ross (1997). *Fuzzy Logic with Engineering Applications*, McGraw-Hill.
3. JSR Jang, CT Sun and E Mizutani (2004). *Neuro-Fuzzy and Soft Computing* (Pearson Education), PHI.

E- REFERENCES:

1. <http://www.nptel.iitm.ac.in/video.php?subjectId=117105084>
2. www.nptel.iitm.ac.in/syllabus/111106049
3. www.iitg.ac.in/rkbc/CE602/GA.pdf

Course Title: INTERNET TECHNOLOGY

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course, student will be able to gain knowledge on concepts of .NET environment and C# basics, to create console application in C# using object-oriented concepts, to integrate C# and ASP.NET in developing web application, to build a web application using database connectivity, to construct a web application with enhanced Add-on services which includes web services, cookies and session

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Acquire the knowledge of .NET environment. Expertise the fundamental concepts in developing the basics of C# programming
CO2	Develop, compile and execute console application in C# using object-oriented concepts. Construct console application in C# program using delegates and events
CO3	Build a web application in ASP.NET using webserver controls
CO4	Demonstrate web application with database connectivity
CO5	Integrate web application using cookies, sessions and web services
CO6	Create a complete web Application for real-time situations

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	2	2	3	2	3	2	3	3	2	3	2	2
CO 2	3	3	3	3	2	3	2	3	2	3	2	3	2
CO 3	3	2	2	3	2	3	2	3	3	3	2	3	2
CO 4	3	2	3	2	2	3	2	3	3	3	2	3	2
CO 5	3	2	2	3	2	3	2	3	3	3	2	2	2
CO 6	3	3	3	2	3	3	3	3	3	3	3	3	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: Introduction to .NET – Overview of C#, Literals, Variables, Data Types, Operators and Expressions, Branching, Looping, Methods, Arrays and Structures, Enumerations.	9	CO1

2	UNIT II: Classes, Objects, Inheritance, Interfaces, Delegates, Events, Errors and Exceptions.	9	CO2
3	UNIT III: Programming Web Applications with Web Forms – Standard Web server Controls – Label, Textbox, Button, Link Button, Image, Image map, Links, Check & Radio button. Rich controls – Calendar, Ad Rotator – List Controls – Check box list, Radio button list, Drop down list, List box, Data controls – Data grid, Repeater – Validation Controls.	9	CO3
4	UNIT IV: Working with Data – OLEDB connection class, command class, data adaptor class, data reader – data set class – Web services.	9	CO4
5	UNIT V: Session & Application Object: Application Object – global.asa file, Webconfig files – creating & reading application variables, Session object – introduction, storing session-information, contents & identifying session, controlling when session ends, creating & reading cookies.	9	CO5, CO6

TEXT BOOKS:

1. E Balagurusamy (2004). *Programming in C#* (3rd edition), Tata McGraw-Hill India. ISBN 9780070702073
2. Stephen Walter (2006). *Asp.net 2.0 Unleashed*, (1st edition), Pearson Education, ISBN 978-8131703236
3. Greg Buczek (2010). *ASP.NET Developer's guide* (1st edition), Tata McGraw-Hill India, ISBN 978-0070499171

REFERENCE BOOKS:

1. Herbert Schildt (2010). *The Complete Reference: C#4.0*, Tata McGraw-Hill Education India ISBN: 9780070703681.
2. Mathew Macdonald (2017). *ASP.NET: The Complete Reference*, McGraw Hill Education, ISBN 978-0070495364
3. Bill Evjen, Scott Hanselman, Devin Rader (2008). *Professional ASP.NET 3.5 In C# and VB* (Pap/Psc edition), Wrox publishers, ISBN 978-0470187579
4. Dino Sposito (2019). *Programming ASP.NET Core*, PHI learning | Microsoft Press, ISBN 978-9388028431

E- REFERENCES:

1. <http://www.csharp-station.com/tutorial.aspx>
2. <http://www.tutorialspoint.com/csharp>
3. <http://asp.net-tutorials.com>
4. <http://www.aspnetbook.com>

Course Title: CLOUD COMPUTING

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course the student will be able to assess fundamental ideas behind cloud computing, the evolution of the paradigm, its applicability and benefits. Public, private and hybrid cloud deployment models and various cloud computing services such as SaaS, PaaS and IaaS. Understand the purpose of Collaboration of cloud with other applications such as calendars, events, projects and social networks. Know the key concepts of Virtualization and its types and outline their roles. Gain the core issues of cloud computing such as security and privacy problems and how they are addressed.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Articulate the main concepts, key technologies, strengths, and limitations, the current and future challenges of cloud computing. Analyse various cloud deployment models and their issues on the cloud.
CO2	Identify the architecture and infrastructure of various cloud services including SaaS, PaaS, and IaaS and apply them to develop a applications.
CO3	Analyse the implications of cloud collaboration with other applications.
CO4	Design and develop various algorithms using tools for virtualization in cloud computing and acquire the knowledge of doing research.
CO5	Assess cloud Storage systems and Cloud security, the risks involved, its impact and develop secure cloud applications.
CO6	Develop and deploy cloud applications using modern tools and techniques based on the organizational needs.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	2	2	2	2	2	3	2	3	2	2
CO 2	3	3	3	2	2	3	3	1	2	3	3	3	2
CO 3	3	2	3	2	3	2	3	3	2	3	2	3	2
CO 4	2	3	3	3	2	3	2	3	2	2	2	2	3
CO 5	3	3	2	3	2	3	2	3	2	3	3	3	3
CO 6	2	2	2	3	3	3	3	3	2	2	3	2	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: Cloud introduction – Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing , usage scenarios and Applications , Business models around Cloud –	9	CO1

	Major Players in Cloud Computing – Issues in Cloud – Eucalyptus – Nimbus – Open Nebula, CloudSim.		
2	UNIT II: Cloud services and file system: Types of Cloud services: Software as a Service – Platform as a Service – Infrastructure as a Service – Database as a Service – Monitoring as a Service – Communication as services.	9	CO2
3	UNIT III: Collaborating with cloud: Collaborating on Calendars, Schedules and Task Management – Collaborating on Event Management, Contact Management, Project Management – Collaborating on Word Processing, Databases – Storing and Sharing Files – Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services Collaborating via Social Networks.	9	CO3
4	UNIT IV: Virtualization for cloud: Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System VM, Process VM, Virtual Machine monitor – Virtual machine properties – Interpretation and binary translation.	9	CO4
5	UNIT V: Security, Standards, and Applications: Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – End user access to cloud computing, Mobile Internet devices and the cloud.	9	CO5, CO6

TEXT BOOKS:

1. Bloor R, Kanfman M, Halper F. Judith Hurwitz (2010). *Cloud Computing for Dummies*, Wiley India Edition.
2. John Rittinghouse & James Ransome (2010). *Cloud Computing Implementation Management and Strategy*, CRC Press.
3. Anthoy T Velte (2009). *Cloud Computing a Practical Approach*, McGraw Hill Publications.

REFERENCE BOOKS:

1. Haley Beard (2008). *Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs*, Emereo Pty Limited.
2. Michael Miller (2008). *Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online*, Que Publishing.
3. James E Smith, Ravi Nair (2006). *Virtual Machines*, Morgan Kaufmann Publishers.

E- REFERENCES:

1. webpages.iust.ac.ir/hsalimi/.../89.../Cloud%20Common%20standards.ppt
2. opennebula.org
3. www.cloudbus.org/cloudsim/
4. <http://www.eucalyptus.com/>
5. http://hadoop.apache.org/docs/stable/hdfs_design.html
6. http://static.googleusercontent.com/external_content/untrusted_dlcp/research.google.com/en//archive/map_reduce-osdi04.pdf

Course Title: BIG DATA ANALYTICS

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40

LEARNING OBJECTIVES:

On taking the course, the students will be able to demonstrate the insight of an exciting growing field of Big Data analytics. They Gain analytical challenges traditional data mining algorithms face when analyzing Big Data, to prove the building initiative of Hadoop, NoSql, MapReduce, to Derive the coding to manage and analyze big data like Hadoop, NoSql, MapReduce. Also, they can exhibit the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability and validate the students to have skills that will help them to solve complex real-world problems in for decision support.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Knows the reason about the evolution of data science and its development. Study the basic of big data analytics and to develop the code. Importance of various kinds of data comparing the other language.
CO2	Develop HDFS environment using NOSQL Implementing the queries. Aggregate the data using NOSQL
CO3	Concept of basic Hadoop, data format and analysing the data in the HDFS environment. Implementing the concept Hadoop pipes and implementations and java interfaces Significance of various methods of compression, serialization
CO4	Apply Mapreduce applications, unit test , MRUnit, Create file using Mapreduce sorting and shuffling process. Creating input and output format of Mapreduce.
CO5	Usage Hadoop related tools. Definition of hbase,Hbase clients, Cassandra, Pig, HiveQL Build data manipulation byHiveQL queries.
CO6	alyze Life Build data manipulation byHiveQL queries.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	2	2	2	2	2	2	1	3	2	2	2	2
CO 2	3	3	2	2	3	1	3	3	1	3	3	3	2
CO 3	3	2	2	2	3	2	3	3	2	3	2	3	2
CO 4	2	3	2	2	2	2	2	2	2	2	2	2	3
CO 5	3	3	2	2	3	2	2	3	2	3	3	3	3
CO 6	2	2	2	3	3	3	3	3	2	2	3	2	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	Understanding big data: What is big data – why big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine.	10	CO1

2	sql data management: Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication – consistency – relaxing consistency – version stamps – map-reduce – partitioning and combining – composing map-reduce calculations.	10	CO2
3	sics of Hadoop: Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures.	10	CO3
4	mapreduce applications: Mapreduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.	10	CO4
5	adoop related tools: hbase – data model and implementations – Hbase clients – Hbase examples – praxis.Cassandra – cassandra data model – cassandra examples – cassandra clients. Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.	5	CO5, CO6

TEXT BOOKS:

1. Minelli, M., Chambers, M., & Dhiraj, A. (2013). *Big data, big analytics: emerging business intelligence and analytic trends for today's businesses*. John Wiley & Sons. Michael, ISBN no: 9781118-14760-354995
2. Sadalage, P. J., & Fowler, M. (2013). *NoSQL distilled: a brief guide to the emerging world of polyglot persistence*. Pearson Education. ISBN no: 13:978-0-321-82662-6
3. Tom White, (2012). *Hadoop: The Definitive Guide*, (Third Edition), O'Reilley. ISBN no: 978-1-491-90163-2
4. Eric Sammer, (2012). *Hadoop Operations*, (First Edition) O'Reilley., ISBN no: 978-1149327057
5. Alan Gates, (2011). *Programming Pig*, (First Edition), O'Reilley. ISBN no: 978-1-449-302641
6. Alex Holmes, (2012). *Hadoop in Practice*, Manning Publ. ISBN no: 9781617292224
7. ECapriolo, D Wampler, and JRutherglen, (2012), *Programming Hive*, O'Reilley.

REFERENCE BOOKS:

1. Lars George, (2011). *HBase: The Definitive Guide*, (First Edition) O'Reilley. ISBN no:10 144396100
2. Eben Hewitt, (2010). *Cassandra: The Definitive Guide*, (First Edition) O'Reilley. ISBN no :9781491933664

E- REFERENCES:

1. Hadoop: <http://hadoop.apache.org/>,
2. Hadoop:<https://www.edureka.co/blog/hadoop-tutorial>
3. Hive: <https://cwiki.apache.org/confluence/display/Hive/Home>
4. Piglatin: <http://pig.apache.org/docs/r0.7.0/tutorial.html>
5. https://www.tutorialspoint.com/apache_pig/apache_pig_grunt_shell.htm

Course Title: CRYPTOGRAPHY

Course Code:	Credits	: 04
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course, student will be able to understand the mathematics behind cryptography, security concepts, vulnerabilities, different types of cryptosystems and attacks on various cryptosystems.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Gain knowledge about Conventional encryption model
CO2	Analyse Euclidean Algorithm and Number theory
CO3	Understanding Key exchanges.
CO4	Detailed representation of Hashing functions.
CO5	Describe the various Digital signatures logic.
CO6	Apply different encryption and decryption techniques

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	2	1	3	1	1	3	3	2	2	3
CO 2	3	2	3	3	3	2	1	2	3	2	2	2	1
CO 3	3	3	3	2	3	1	1	1	3	2	2	3	2
CO 4	3	3	1	3	2	3	2	2	3	2	2	3	3
CO 5	3	3	2	2	2	2	1	1	3	3	3	3	2
CO 6	3	3	2	2	2	2	2	1	3	3	3	3	1

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: Conventional encryption model –Security Concepts- Substitution and Transposition Ciphers- DES algorithm –AES algorithm - Random number generation.	7	CO1
2	UNIT II: Number Theory: Modular arithmetic – Euler’s theorem – Euclid’s algorithm – Extended Euclidean Algorithm and its	15	CO2, CO3

	applications- Chinese remainder theorem – Prime numbers and factorization –Discrete Logarithms.		
3	UNIT III: Principles of Public key Cryptography– RSA algorithm – Key Management- Diffie – Hellman key exchange	8	CO4
4	UNIT IV: Message Authentication and Hash functions: Authentication requirements –Authentication function- Message Authentication codes-Hash functions-Secure Hash Algorithm.	8	CO5
5	UNIT V: Digital Signature and Authentication Protocols: Digital Signature Authentication Protocols –Digital Signature Standard.	7	CO6

TEXT BOOKS:

1. Stallings. W (2013). *Cryptography and Network Security, Principles and Practice*, Pearson Education, Delhi,ISBN:9788131761663.

REFERENCE BOOKS:

1. Charlie Kaufman, Radia Perlman, Mike specimen (2016). *Network Security Private Communication in a public world*, Prentice Hall PTR, ISBN: 9789332586000.
2. Michael Welsehenbach (2013). *Cryptography in C & C++*, Apress, ISBN:9781430250999.

E- REFERENCES:

1. <http://www.webopedia.com/TERM/C/cryptography.html>
2. <http://www.sagemath.org/pdf/en/reference/cryptography/cryptography.pdf>
3. <http://www.freetechbooks.com/lecture-notes-on-cryptography-t565.html>
4. <https://nptel.ac.in/courses/106105031/>
5. <https://nptel.ac.in/courses/106105162/>

Course Title: INFORMATION SECURITY

Course Code:	Credits	: 03
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course the student will be able to understand and revise the common threats faced today, To understand the foundational theory behind information security and analyze What are the basic principles and techniques when designing a secure system, to apply attacks and defenses work in practice and how to assess threats for their significance and how to gauge the protections and limitations provided by today's technology.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Understand Information Security Principles such as security attacks and services.
CO2	Design Terms, concepts related to public key cryptography and digital signatures.
CO3	Apply the Concepts of various privacy methods.
CO4	Analyse Typical Network Attacks and Threats from the Internet.
CO5	Create SNMP, Firewall design Principles and Intrusion detection system.
CO6	Create the protections and limitations provided by internet security technology

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	2	2	3	3	3	2	3
CO 2	3	3	3	3	3	3	3	2	3	3	3	2	3
CO 3	3	3	3	3	3	3	2	2	3	3	3	3	3
CO 4	3	3	3	3	3	2	2	2	3	3	3	3	3
CO 5	3	3	3	3	3	3	2	3	3	3	3	3	3
CO 6	3	3	3	3	3	3	2	2	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I: Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms.	9	CO1
2	UNIT II: Public key cryptography principles, public key cryptography algorithms, digital signatures, digital Certificates,	9	CO2

	Certificate Authority and key management Kerberos,X.509 Directory Authentication Service		
3	UNIT III: Email privacy: Pretty Good Privacy (PGP) and S/MIME.P Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management	9	CO3
4	UNIT IV: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET	9	CO4
5	UNIT V: Basic concepts of SNMP, SNMPv1 Community facility and SNMPv3, Intruders, Viruses and related threats Firewall Design principles, Trusted Systems, Intrusion Detection Systems	9	CO5, CO6

TEXT BOOKS:

- 1 William Stallings (2008). *Network Security Essentials (Applications and Standards)*, Pearson Education.
- 2 Chris McNab(2016). *Network Security* (3rd edition), O'Reilly Media.
- 3 Joseph Migga Kizza (2014). *Computer Network Security*, Springer International Publishing.

REFERENCE BOOKS:

- 1 Eric Maiwald(2004). *Fundamentals of Network Security*, Dreamtech press.
- 2 CharlieKaufman, Radia Perlman and Mike Speciner. *Network Security – Private Communication in a Public World* (Second Edition), Pearson/PHI.

E- REFERENCES:

- 1 <http://www.freotechbooks.com/an-introduction-to-computer-security-the-nist-handbook-t725.html>
- 2 <http://www.freotechbooks.com/fundamentals-of-cryptology-t801.html>

Course Title: INTERNET SECURITY AND COMPUTER FORENSICS

Course Code:	Credits	: 03
L:T:P:S : 4:0:0:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course, student will be able to understand the main issues related to security in modern networked computer systems, the underlying concepts and foundations of computer security, basic knowledge about security-relevant decisions in designing IT infrastructures, understand Computer forensics fundamental, understand collecting, investigating, preserving, and presenting evidence of cybercrime left in digital storage devices, analyze various computer forensics technologies and to identify methods for data recovery.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Gain a good understanding of the concepts and foundations of computer security and identify vulnerabilities of IT systems
CO2	Analyse basic security tools to enhance system security and can develop basic security enhancements in stand-alone applications
CO3	Identify some of the factors driving the need for network security and analyse various computer forensics systems
CO4	Analyse and summarize duplication and preservation of digital evidence
CO5	Illustrate the methods for data recovery, evidence collection and data seizure.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	2	1	3	1	1	3	3	2	2	3
CO 2	3	2	3	3	3	2	1	2	3	2	2	2	1
CO 3	3	3	3	2	3	1	1	1	3	2	2	3	2
CO 4	3	3	1	3	2	3	2	2	3	2	2	3	3
CO 5	3	3	2	2	2	2	1	1	3	3	3	3	2
CO 6	3	3	3	2	1	3	1	1	3	3	2	2	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	UNIT I - NETWORK LAYER SECURITY & TRANSPORT LAYER SECURITY IPSec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPSec . Transport layer Security: SSL protocol, Cryptographic Computations - TLS Protocol. 189 CS-Engg&Tech-SRM-2013	8	CO1

2	UNIT II - E-MAIL SECURITY & FIREWALLS PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls - Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.	10	CO2
3	UNIT III - INTRODUCTION TO COMPUTER FORENSICS (9 hours) Computer Forensics Fundamentals – Types of Computer Forensics – Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition	9	CO3
4	UNIT IV - EVIDENCE COLLECTION AND FORENSICS TOOLS Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.	9	CO4
5	UNIT V - ANALYSIS AND VALIDATION Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics	9	CO5

TEXT BOOKS:

1. Man Young Rhee (2003). *Internet Security: Cryptographic Principles, Algorithms and Protocols*, Wiley Publications.

REFERENCE BOOKS:

1. Nelson, Phillips, Enfinger, Steuart (2014). *A Guide to Computer Forensics and Investigations* Cengage Learning, ISBN: 9781305176089.
2. John R.Vacca (2002). *Computer Forensics*, Firewall Media, ISBN: 1584503890.
3. Richard E.Smith (2008). *Internet Cryptography* (3rd Edition), Pearson Education, ISBN: 8131704122.
4. MarjieT.Britz (2013), *Computer Forensics and Cyber Crime: An Introduction* (1st Edition), Pearson Education, ISBN: 0132677717.

E- REFERENCES:

1. <https://www.geeksforgeeks.org/information-security-and-computer-forensics/>
2. <https://nptel.ac.in/courses/106106178/>

Course Title: PRACTICAL-V: INTERNET TECHNOLOGY LAB

Course Code:	Credits	: 02
L:T:P:S : 0:0:5:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking this course, student will be able to develop simple console applications using control flow, loops, arrays, to create console application using strings, delegates and events, to design and develop console applications using object-oriented concepts, to create simple web page using ASP.NET, to design a website utilizing database and connect to the database from ASP.NET, to develop web application using cookies, sessions and Web services.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Design the algorithm
CO2	Develop console application using C#
CO3	Build and develop web-application using ASP.NET controls and validations
CO4	Develop web application using ASP.NET incorporating database connection
CO5	Develop web application using ASP.NET using cookies and session
CO6	Synthesize console and web application based on requirements

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	2	3	2	2	3	2	3	2	2	3	3	3
CO 2	3	3	3	3	3	3	2	3	3	3	3	3	2
CO 3	3	2	2	3	2	3	2	3	3	3	2	3	2
CO 4	3	2	3	2	2	3	2	3	3	3	2	3	2
CO 5	3	2	2	3	2	3	2	3	3	3	2	2	2
CO 6	3	3	3	2	3	3	2	3	3	3	3	3	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	C# 1. Creating a simple Console application 2. Programs using Array and Array List 3. Programs using string 4. Create a console application containing classes and Inheritance	23	CO1, CO2, CO6

	<ul style="list-style-type: none"> 5. Programs using Interface 6. Programs using Structures and Enumerations 7. Create a console application to implement delegates 8. Create a console application for exception handling 		
2	<ul style="list-style-type: none"> 1. Create a Website containing various standard controls 2. Create a Webform that demonstrate using Validator controls 3. Create a Website that contains AdRotator and Calendar controls. 4. Create a Web application using Data Base Connections 5. Create a Web application using web services 	22	CO3, CO4, CO5, CO6

Course Title: PRACTICAL-VI: BIG DATA ANALYTICS LAB

Course Code:	Credits	: 02
L:T:P:S : 0:0:5:0	CIA Marks	: 40
Exam Hours: 03	ESE Marks	: 60

LEARNING OBJECTIVES:

On taking the course, the students will be able to demonstrate the insight of an exciting growing field of Big

Data analytics. They can derive the scripts of Hadoop, NoSql, MapReduce to develop the knowledge of data science. To derive the coding, manage and analyze big data like Hadoop, No Sql, MapReduce. Practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Derive the steps of algorithms for every exercise.
CO2	Scaling up machine learning techniques focusing on industry applications.
CO3	Exhibit the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
CO4	Implementation of big data analytics
CO5	Practice bigdata tools Pig, Hive etc.
CO6	Validate the students to have skills that will help them to solve complex real-world problems in for decision support.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	2	2	2	2	2	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	1	3	3	3	2
CO 3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 4	2	3	2	2	2	2	2	2	2	2	2	2	3
CO 5	3	3	2	2	3	3	3	3	3	3	3	3	3
CO 6	2	2	2	3	3	3	3	3	2	2	3	2	2

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

S.No	CONTENTS OF MODULE	Hrs	COs
1	Perform setting up and Installing Hadoop in its three operating modes: Standalone, Pseudo distributed, fully distributed Use web based tools to monitor your Hadoop setup.	9	CO1
2	Implement the following file management tasks in Hadoop: a) Adding files and directories b) Retrieving files	9	CO2

	Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.		
3	Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.	9	CO3
4	Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.	9	CO4
5	Implement Matrix Multiplication with Hadoop Map Reduce	9	CO5
6	Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.	5	CO6
7	Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.	4	CO6

Course Title: SPOKEN TUTORIAL - JAVA

S.No	CONTENTS OF MODULE
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1	<p>Getting started java Installation – First Java Program – Installing Eclipse – Getting started Eclipse-Hello World Program in Eclipse – Errors and Debugging in Eclipse – Programming features Eclipse – Numerical Datatypes – Arithmetic Operations – Strings – Primitive type conversions – Relational Operations – Logical Operations – if else – Nested if – switch case – while loop – For loop – do while – introduction to Array – Array operations – creating class – creating object – instance fields – Methods – Default constructor – Parameterized constructors – using this keyword – Non static block – Constructor overloading – Method overloading – userinput – subclassing and method overriding – Calling methods of the superclass – Using final keyword – Polymorphism – Abstract Classes – Java Interfaces – Static Variables – Static Methods – Static Blocks.</p>
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Note:

Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.

FOURTH SEMESTER (SYLLABUS)

Course Title: PROJECT & VIVA-VOCE

Course Code:	Credits	: 15
L:T:P:S : 0:0:0:0	CIA Marks	: 40

LEARNING OBJECTIVES:

On taking the course, the students will be able to Implement the solution for the chosen problem using the concepts and the techniques learnt in the curriculum, Identify, formulate and implement computing solutions, Design and conduct experiments, analyze and interpret data, Record the result, demonstrate skills to use modern tools, software and equipments to analyse the chosen problem.

Course Outcomes: At the end of the Course, the Student will be able to:

CO1	Demonstrate a depth of knowledge of modern technology.
CO2	Complete an independent research project, resulting in dissertation.
CO3	Communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.
CO4	Self-study, reflect on their learning and take appropriate actions to improve it.

Mapping of Course Outcomes to Program Outcomes:

CO/PO/PSO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO 1	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO 4	3	3	3	3	3	3	3	3	3	3	3	3	3

3-Strong Correlation 2- Medium Correlation 1- Low Correlation

PROCEDURE

- The final semester will be entirely assigned for the student to carry out their project work.
- The Head of the Department will assign an Internal Guide for each student.
- The students should submit the contact details of the organization to their guide.
- During regular intervals, student should report his/her progress of the project work.
- After the submission of the final report, an external examiner will evaluate the project document and conduct the viva voce examination.

Course Title: SPOKEN TUTORIAL - LATEX

S.No	CONTENTS OF MODULE
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1	Beamer – Bibliography – Equations – Inside Story of Bibliography – Latex on Windows using Texworks – Letter-Writing – Mathematical Typesetting – Report Writing – Tables and Figures.
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Note:

Courses Offered by IIT Mumbai through Spoken Tutorial Projects MHRD, Government of India. At the end of the course Online Examination will be conducted for 45 minutes and qualified students (Minimum passing 40%) will be issued certificate by IIT, Mumbai.

APPENDIX A: OUTCOME-BASED EDUCATION (OBE)

Outcome-Based Education (OBE) is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve stated objectives and outcomes. It focuses on measuring student performance i.e. outcomes at different levels.

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation.

Program Educational Objectives (PEOs)

The Program Educational Objectives of a program are the statements that describe the expected achievements of graduates in their career, and also in particular, what the graduates are expected to perform and achieve during the first few years after graduation

Program Outcomes (POs)

Program outcomes are finer statements that designate what students are expected to be able to do by the time of graduation. POs are expected to be aligned closely with Graduate Attributes.

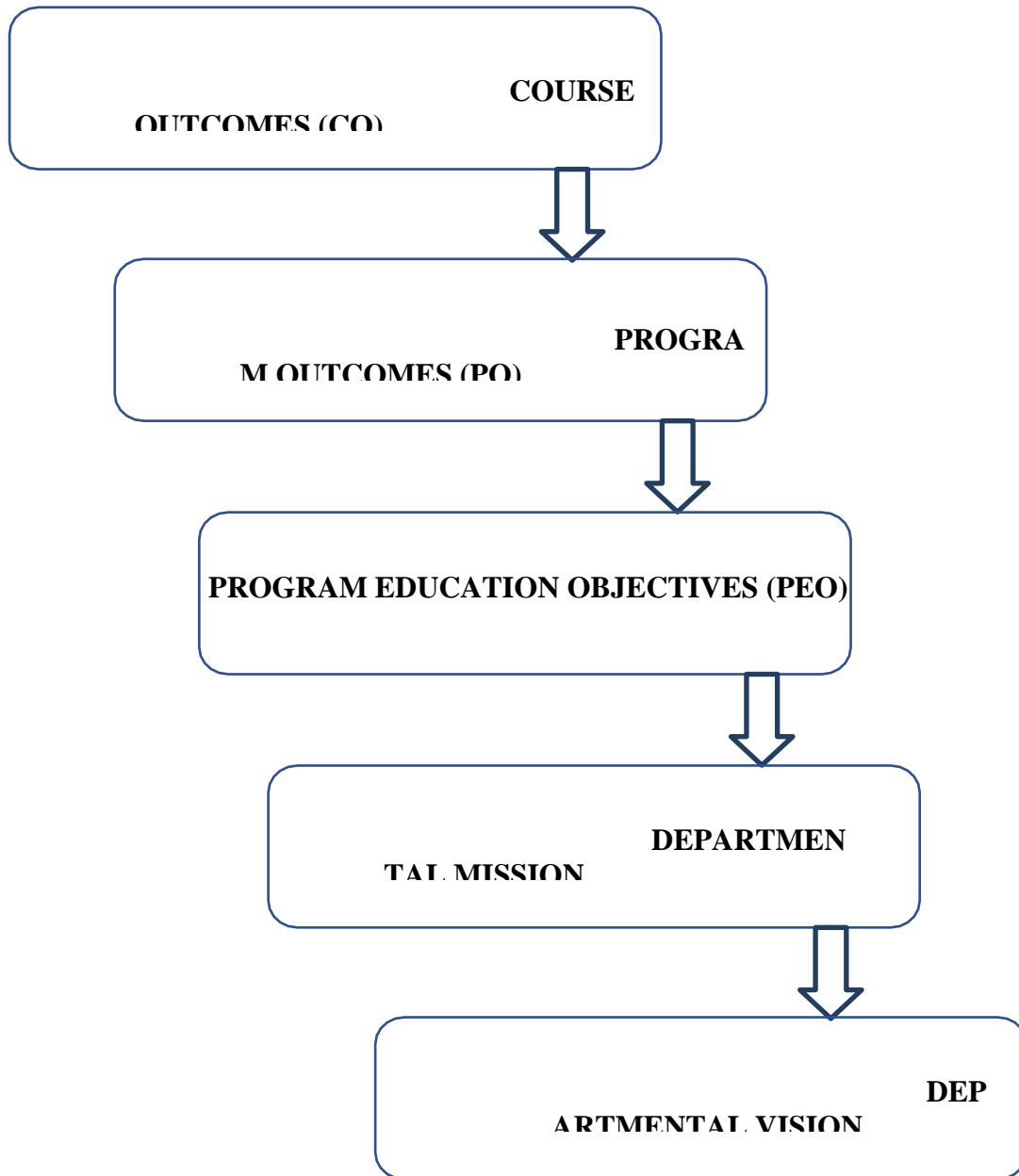
Program Specific Outcomes (PSO)

Program Specific Outcomes are what the students should be able to do at the time of graduation with reference to a specific discipline.

Course Outcome (CO)

Course outcomes are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course.

MAPPING OF OUTCOMES



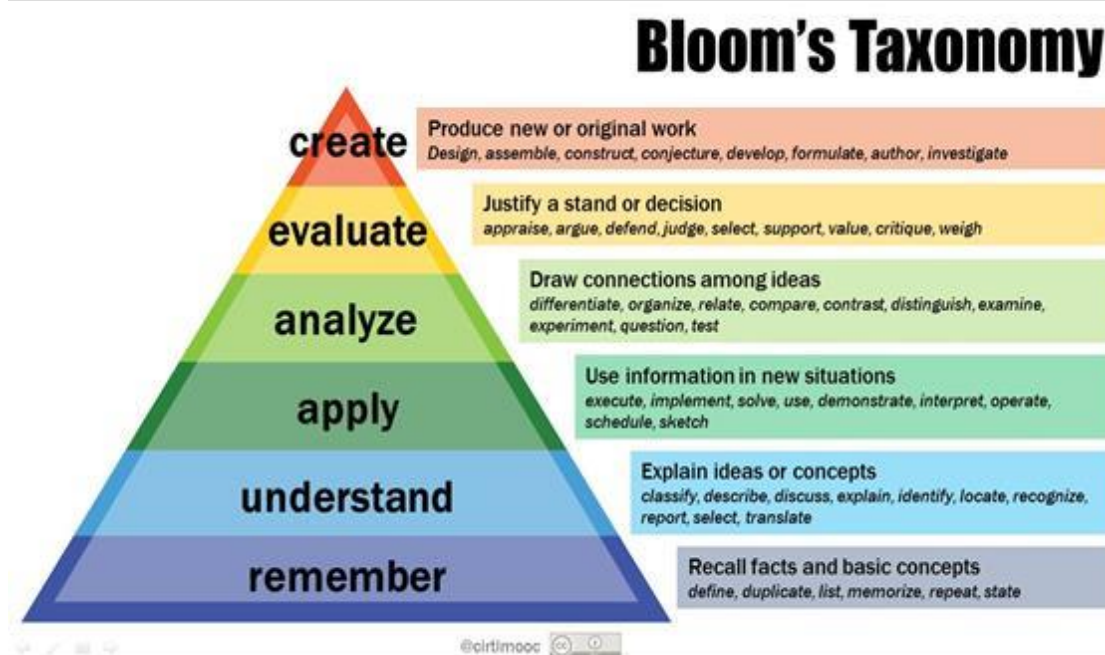
APPENDIX B: PROGRAM OUTCOMES IN RELATION TO GRADUATE ATTRIBUTES

S.No	GRADUATE ATTRIBUTES	PROGRAMME OUTCOMES
1.	Knowledge	Capability of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an postgraduate programme of study
2.	Critical Thinking	Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.
3.	Problem Solving	Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.
4.	Usage of modern tools	Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.
5.	Communication	Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.
6.	Life-long Learning	Ability to acquire knowledge and skills, including 'learning how to learn', that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
7.	Ethical Practices and Social Responsibility	Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work.
8.	Independent and Reflective Learning	Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society

APPENDIX C: BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies. [eduglosarry.org]

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy



Level	Parameter	Description
K1	Knowledge	It is the ability to remember the previously learned material/information
K2	Comprehension	It is the ability to grasp the meaning of material
K3	Application	It is the ability to use learned material in new and concrete situations
K4	Analysis	It is the ability to break down material/concept into its component parts/subsections so that its organizational structure may be understood
K5	Synthesis	It is the ability to put parts/subsections together to form a new whole material/idea/concept/information
K6	Evaluation	It is the ability to judge the value of material/concept/statement/creative material /research report) for a given purpose