<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P-Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT201</td>
<td>Digital System Design</td>
<td>3-1-0-4</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** Nil

**Course Objectives**
1. To impart an understanding of the basic concepts of Boolean algebra and digital circuit design.
2. To provide familiarity with the design and implementation of different types of practically used combinational and sequential circuits.
3. To provide an introduction to Hardware Description Language
4. To expose the students to basics of arithmetic algorithms

**Syllabus**
Introduction to Number Systems, Boolean Algebra, Canonical Forms, Logic Gates, Digital Circuit Design - Combination Logic Circuit Design, Sequential Circuit Design, Registers, Counter, Memory modules, Programmable Logical Arrays, Hardware Description Language for Circuit Design, Case study with VHDL, Arithmetic algorithms

**Expected Outcomes**
Student will be able to:-
1. Apply the basic concepts of Boolean algebra for the simplification and implementation of logic functions using suitable gates namely NAND, NOR etc.
2. Design simple Combinational Circuits such as Adders, Subtractors, Code Convertors, Decoders, Multiplexers, Magnitude Comparators etc.
3. Design Sequential Circuits such as different types of Counters, Shift Registers, Serial Adders, Sequence Generators.
4. Use Hardware Description Language for describing simple logic circuits.
5. Apply algorithms for addition/subtraction operations on Binary, BCD and Floating Point Numbers.

**Text Books:**

**References:**
<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Contact Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Number systems – Decimal, Binary, Octal and Hexadecimal – conversion from one system to another – representation of negative numbers – representation of BCD numbers – character representation – character coding schemes – ASCII – EBCDIC etc. Addition, subtraction, multiplication and division of binary numbers (no algorithms). Addition and subtraction of BCD, Octal and Hexadecimal numbers Representation of floating point numbers – precision – addition, subtraction, multiplication and division of floating point numbers</td>
<td>10</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Introduction — Postulates of Boolean algebra – Canonical and Standard Forms – logic functions and gates Methods of minimization of logic functions — Karnaugh map method and Quine- McClusky method Product-of-Sums Simplification — Don’t-Care Conditions.</td>
<td>09</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>Combinational Logic: combinational Circuits and design procedure — binary adder and subtractor — multi—level NAND and NOR circuits — Exclusive-OR and Equivalence Functions. Implementation of combination logic: parallel adder, carry look ahead adder, BCD adder, code converter, magnitude comparator, decoder, multiplexer, demultiplexer, parity generator.</td>
<td>09</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Sequential logic circuits: latches and flip-flops – edge triggering and level-triggering — RS, JK, D and T flipflops — race condition — master-slave flip-flop. Clocked sequential circuits: state diagram — state reduction and assignment — design with state equations</td>
<td>07</td>
<td>15%</td>
</tr>
<tr>
<td>V</td>
<td>Registers: registers with parallel load - shift registers universal shift registers – application: serial adder.</td>
<td>08</td>
<td>20%</td>
</tr>
</tbody>
</table>
Counters: asynchronous counters — binary and BCD
ripple counters — timing sequences —
synchronous
counters — up-down counter, BCD counter,
Johnson
counter, Ring counter

Memory and Programmable Logic: Random-Access
Memory (RAM)—Memory Decoding—Error
Detection and Correction — Read only Memory
(ROM), Programmable Logic Array (PLA).
HDL: fundamentals, combinational logic, adder,
multiplexer.
Case Study : Implementation of 4-bit adder and
4-bit by 4-bit multiplier using VHDL
Arithmetic algorithms: Algorithms for addition
and subtraction of binary and BCD numbers,
algorithms for floating point addition and
subtraction, Booth’s Algorithm

10 20%

QUESTION PAPER PATTERN (End semester examination)
Maximum Marks : 100 Exam Duration: 3 hours

Part A – (Modules I and II) 2 out of 3 questions (uniformly covering the two modules) are to be answered. Each question carries 15 marks and can have a maximum of 4 sub divisions

Part B – (Modules III and IV) 2 out of 3 questions (uniformly covering the two modules) are to be answered. Each question carries 15 marks and can have a maximum of 4 sub divisions

Part C – (Modules V and VI) 2 out of 3 questions (uniformly covering the two modules) are to be answered. Each question carries 20 marks and can have a maximum of 4 sub divisions
Course No. | Course Name | L-T-P - Credits | Year of Introduction
--- | --- | --- | ---
IT202 | Algorithm Analysis & Design | 4-0-0-4 | 2016

**Prerequisite:** CS205 Data structures

**Course Objectives**
- To develop an understanding about basic algorithms and different problem solving strategies.
- To improve creativeness and the confidence to solve non-conventional problems and expertise for analysing existing solutions.

**Syllabus**

**Expected outcome .**
The students will be able to
- Describe the performance analysis of algorithms and asymptotic notations.
- Solve recurrence equations using iteration and recursion tree methods.
- Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
- Discuss greedy and dynamic programming in algorithm design and recite algorithms that employ this paradigm.
- Explain backtracking and branch and bound technique used in algorithms
- Interpret the approximation algorithms, randomized algorithms and string matching algorithms

**Text Book:**
1 Fundamentals of Computer Algorithms – Horowitz and Sahni, Galgotia

**References:**
2. Data Structures algorithms and applications – Sahni, Tata McGrHill
4. Introduction to algorithm- Thomas Coremen, Charles, Ronald Rivest -PHI

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
</table>

| II  | **Divide and Conquer** - Control Abstraction, Finding Maximum and Minimum, Binary Search, Divide and Conquer Matrix Multiplication, Stressen’s Matrix Multiplication, Quick Sort, Merge Sort. | 8   |
|     | **FIRST INTERNAL EXAMINATION**                                                  | 15% |
| III | **Greedy Strategy**- Control Abstraction, General Knapsack Problem, Minimum Cost Spanning Trees – PRIM’s Algorithm, Kruskal’s Algorithm, Job sequencing with deadlines. | 8   |
| IV  | **Backtracking**- State Space Tree - Fixed Tuple and Variable Tuple Formulation - Control Abstraction – Generating Function and Bounding Function - Efficiency of the method - Monte Carlo Method – N-Queens Problem, Sum of Subsets. **Branch and Bound Techniques**– FIFO, LIFO, and LC Control Abstractions, 15-puzzle. | 9   |

| V   | **Dynamic Programming**- Principle of Optimality, Multistage Graph Problem, Forward Approach, Backward Approach, All-Pairs Shortest Paths, Traveling Salesman Problem. Sophisticated Algorithms- Approximation Algorithms – Planar Graph Coloring, Vertex cover | 10  |


**SECOND INTERNAL EXAMINATION**

**VI**

**END SEMESTER EXAM**

**QUESTION PAPER PATTERN** (End semester examination)

- **Maximum Marks**: 100
- **Exam Duration**: 3 Hrs

**Part A** – (Modules I and II) 2 out of 3 questions (uniformly covering the two module) are to be answered. Each question carries 15 marks and can have a maximum of 4 sub divisions

**Part B** – (Modules III and IV) 2 out of 3 questions (uniformly covering the two module) are to be answered. Each question carries 15 marks and can have a maximum of 4 sub divisions

**Part C** – (Modules V and VI) 2 out of 3 questions (uniformly covering the two module) are to be answered. Each question carries 20 marks and can have a maximum of 4 sub divisions
<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P</th>
<th>Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT203</td>
<td>Data Communication</td>
<td>3-0-0</td>
<td>3</td>
<td>2016</td>
</tr>
</tbody>
</table>

Prerequisite: Nil

Course Objectives

- Build an understanding of the fundamental concepts of data transmission.
- Familiarize the student with the basics of encoding of analog and digital data
- Preparing the student for understanding advanced courses in computer networking

Syllabus


Expected Outcome

After the successful completion of the course students will be able to

- Explain Data Communications concepts and its components.
- Identify the different types of Transmission media and their functions within a network.
- Independently understand encoding, decoding, error correction and error detection in data communication
- To understand switching principles and basics of wireless communication

References

<table>
<thead>
<tr>
<th>Module</th>
<th>Course Plan</th>
<th>Hours</th>
<th>End-Semester Exam marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Communication model Simplex, half duplex and full duplex transmission. Time Domain and Frequency Domain concepts - Analog &amp; Digital data and signals - Transmission Impairments - Attenuation, Delay distortion, Noise - Different types of noise Channel capacity - Shannon's Theorem - Transmission media-twisted pair, Coaxial cable, optical fiber, terrestrial microwave, satellite microwave.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Synchronous and Asynchronous transmission. Sampling theorem - Encoding digital data into digital signal - NRZ, Biphas, Multilevel binary - Encoding digital data into analog signals - ASK, FSK, PSK</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td><strong>FIRST INTERNAL EXAM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Encoding analog data into digital signals - PCM, PM, DM - Encoding analog data into analog signals - AM, FM, PM. Multiplexing - TDM, FDM, WDM &amp; DWDM Encoding techniques, Spread spectrum-The concept of spread spectrum – frequency hopping spread spectrum – direct sequence spread spectrum – code division multiple access</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Purpose of encoding, Instantaneous codes, Construction of instantaneous codes. Construction of basic source codes. Huffman coding, Arithmetic coding, ZIP coding. Error Detecting and correcting codes. Error detection - parity check, Forward Error Correction. Block codes, Convolution codes.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td><strong>SECOND INTERNAL EXAM</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Cyclic codes: - Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection -CRC, VRC. Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.</td>
<td>7</td>
<td>20%</td>
</tr>
</tbody>
</table>
VI

Hamming codes, Encoding and decoding of systematic and unsystematic codes

Basic principles of switching - circuit switching, packet switching, message switching.

Basics of wireless communication, Introduction to WiFi, WiMax, GSM, GPRS.

<p>| | | |</p>
<table>
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<tr>
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<tbody>
<tr>
<td>VI</td>
<td></td>
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</tr>
</tbody>
</table>

7
20%

END SEMESTER EXAM

QUESTION PAPER PATTERN (End semester examination)

Maximum Marks : 100
Exam Duration: 3 Hrs

Part A – (Modules I and II) 2 out of 3 questions (uniformly covering the two module) are to be answered. Each question carries 15 marks and can have a maximum of 4 sub divisions

Part B – (Modules III and IV) 2 out of 3 questions (uniformly covering the two module) are to be answered. Each question carries 15 marks and can have a maximum of 4 sub divisions

Part C – (Modules V and VI) 2 out of 3 questions (uniformly covering the two module) are to be answered. Each question carries 20 marks and can have a maximum of 4 sub divisions
Course No. | Course Name               | L-T-P | Credits | Year of Introduction |
------------|--------------------------|-------|---------|----------------------|
IT204       | Object Oriented Techniques | 3-0-0 | 3       | 2016                 |

Prerequisite : Nil

Course Objectives
- To build an understanding of basic concepts of object oriented programming techniques
- To develop programming skills in C++ programming language
- To implement object oriented techniques using C++ language features.
- To develop software using object oriented programming paradigms

Syllabus
Characteristics of Object-Oriented Languages - Objects and Classes - Arrays and Strings - Operator Overloading – Overloading Unary Operators - Overloading Binary Operators - Arrays as Class Member Data - Inheritance – Derived Class and Base Class - Class Hierarchies - Public and Private Inheritance - Levels of Inheritance - Multiple Inheritance - Pointers - The Address-of Operator - Pointers and Arrays - Pointers and Functions - Memory Management - Pointers to Objects - Virtual Functions - Late Binding - Friend Functions - Static Functions - Assignment and Copy Initialization - The this Pointer - Streams and Files - Stream Classes - File Pointers - Templates and Exceptions - Function Templates - Class Templates - Exceptions

Expected Outcome
After the successful completion of the course students will be able to
- Explain Object Oriented Programming concepts.
- To understand the special features of C++ Programming language
- To upgrade existing procedure oriented softwares to object oriented based ones

References
<table>
<thead>
<tr>
<th>Module</th>
<th>Course Plan</th>
<th>Hours</th>
<th>% of Marks in End-Semester Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Why Do We Need Object-Oriented Programming? - Procedural Languages - The Object-Oriented Approach - Characteristics of Object-Oriented Languages - Objects - Classes - Inheritance - Reusability - Creating New Data Types - Polymorphism and Overloading - C++ and C - Objects and Classes - A Simple Class - Classes and Objects - Defining the Class - Using the Class - Calling Member Functions - C++ Objects as Physical Objects - C++ Objects as Data Types – Constructors – Destructors - Objects as Function Arguments - Overloaded Constructors - Member Functions Defined Outside the Class - Objects as Arguments - The Default Copy Constructor - Static Class Data - const and Classes</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>II</td>
<td>Arrays and Strings - Array Fundamentals - Arrays as Class Member Data - Arrays of Objects - The Standard C++ string Class - Operator Overloading - Overloading Unary Operators - Overloading Binary Operators - Data Conversion</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>III</td>
<td>Inheritance - Derived Class and Base Class - Derived Class Constructors - Overriding Member Functions - Which Function Is Used? - Class Hierarchies - Public and Private Inheritance - Levels of Inheritance - Multiple Inheritance</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>IV</td>
<td>Pointers - Addresses and Pointers - The Address-of Operator &amp; - Pointers and Arrays - Pointers and Functions - Memory Management: new and delete - Pointers to Objects</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>V</td>
<td>Virtual Functions - Friend Functions - Static Functions - Assignment and Copy Initialization - The this Pointer - Streams and Files - Stream Classes - Stream Errors - Disk File I/O with Streams - File Pointers - File I/O with Member</td>
<td>8</td>
<td>20</td>
</tr>
</tbody>
</table>
VI

Templates and Exceptions - Function Templates - Class Templates
Exceptions - Exception Syntax - Multiple Exceptions - Exceptions with Arguments

END SEMESTER EXAM

QUESTION PAPER PATTERN (End semester examination)

Maximum Marks : 100  
Exam Duration: 3 Hrs

Part A – (Modules I and II) 2 out of 3 questions (uniformly covering the two module) are to be answered. Each question carries 15 marks and can have a maximum of 4 sub divisions

Part B – (Modules III and IV) 2 out of 3 questions (uniformly covering the two module) are to be answered. Each question carries 15 marks and can have a maximum of 4 sub divisions

Part C – (Modules V and VI) 2 out of 3 questions (uniformly covering the two module) are to be answered. Each question carries 20 marks and can have a maximum of 4 sub divisions
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<thead>
<tr>
<th>Course No.</th>
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<th>L-T-P</th>
<th>Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT231</td>
<td>Digital Circuits Lab</td>
<td>0-0-3</td>
<td>1</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Course Objectives**

- To familiarise various types of gates
- To realize adders, subtractors, flip flops
- To Realise shift registers and counters.
- To assemble digital circuits using ICs and study the performance.

**List of Exercises / Experiments (Minimum of 8 mandatory out of 10)**

1. Realization of functions using basic and universal gates.

2. Adders and Subtractors *(Any four)*
   
   i) Half adder using NAND and NOR only.
   
   ii) Full adder using NAND and NOR only.
   
   iii) Full adder using two half adders
   
   iv) Half subtractor using NAND and NOR only.
   
   v) Full subtractor using NAND and NOR only.

3. 2/3 bit binary comparator.

4. BCD to Decimal and BCD to 7 segment decoder & display

5. Multiplexers, De-multiplexers using gates and ICs. (74150, 74154)

6. Realization of combinational circuits using MUX & DEMUX.

7. Realization of flip flops using gates. *(Any four)*
   
   i) RS flip-flops
   
   ii) T flip-flops
   
   iii) D flip-flops
   
   iv) JK flip-flops
v) Master Slave flip-flops

8. Random sequence generator.

9. Realisation of Shift Registers.

10. Counters (using flip flops)

i) Synchronous counters

ii) Asynchronous counters

iii) Ring counter

iv) Johnson counter

Class Project (Minimum one mandatory per group)

i) Implementation of digital clock

ii) Implementation of digital timer

iii) Implementation of event counter

iv) Implementation of token display

Expected Outcome
From the practical exposure, the students can design digital circuits such as registers, counters, arithmetical circuits, flip flops etc.

References
<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Name</th>
<th>L-T-P</th>
<th>Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT232</td>
<td>Object Oriented Programming Lab</td>
<td>0-0-3</td>
<td>1</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite :** IT202  Object oriented techniques

**Course Objectives**
- Provide hands-on experience to students in implementing object oriented programming concepts

**Syllabus**
Programs Using Function - Simple Classes for understanding objects, member functions and Constructors - Compile time Polymorphism - Runtime Polymorphism – Pointers – Inheritance - File Handling – Exception handling

**Expected Outcome**
The students will be able to
- Design, develop and troubleshoot software based on object oriented programming methodologies.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Programs Using Functions&lt;br&gt;a. Functions with default arguments&lt;br&gt;b. Implementation of Call by Value, Call by Address and Call by Reference</td>
</tr>
<tr>
<td>II</td>
<td>Simple Classes for understanding objects, member functions and Constructors&lt;br&gt;a. Classes with primitive data members&lt;br&gt;b. Classes with arrays as data members&lt;br&gt;c. Classes with pointers as data members – String Class&lt;br&gt;d. Classes with constant data members&lt;br&gt;e. Classes with static member functions</td>
</tr>
<tr>
<td>III</td>
<td>Compile time Polymorphism&lt;br&gt;a. Operator Overloading including Unary and Binary Operators.&lt;br&gt;b. Function Overloading</td>
</tr>
<tr>
<td>IV</td>
<td>Runtime Polymorphism&lt;br&gt;a. Inheritance – Simple, Multiple, Multi-level, Hierarchical and Hybrid&lt;br&gt;b. Virtual functions&lt;br&gt;c. Virtual Base Classes</td>
</tr>
<tr>
<td>V</td>
<td>File Handling&lt;br&gt;a. Sequential access&lt;br&gt;b. Random access</td>
</tr>
<tr>
<td>VI</td>
<td>Exception handling&lt;br&gt;a. exception handling mechanisms&lt;br&gt;b. specifying exception</td>
</tr>
<tr>
<td>Course No.</td>
<td>Course Name</td>
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<tr>
<td>IT234</td>
<td>Algorithm Design Lab</td>
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</tbody>
</table>

**List of Exercises/Experiments:**

1. Time Space Trade off implementation
2. Time analysis of different Sorting and Searching Methods.
3. String matching algorithms
5. Shortest path using Dijkstra’s algorithm
6. Implement minimum spanning tree algorithms – Prim’s and Kruskal’s
7. Dynamic Programming implementation
8. Backtracking method implementation

**Sample Lab cycle**

- **An experiment to understand the concept of time space trade off**

- **Sorting**
  Sorting Time Calculation for 10, 100, 1K, 10K, 100K numbers by varying input patterns. Create three set of input files. i) Sorted Numbers, ii) Reverse Sorted iii) Random Numbers. Plot the graph with input size & time for
  - Bubble Sort, Insertion Sort, Selection Sort, Quick Sort Vs Randomized Quick Sort, Merge Sort, Heap Sort, by creating a Binary Search Tree, by creating an AVL tree

- **Searching**
  Searching Time Calculation for 10, 100, 1K, 10K, 100K numbers by varying input patterns. Plot the graph with input size & time
  - Sequential Search; Binary Search; Interpolation Search

- **String Matching**
  Trivial String Matching ; Rabin- Karp Algorithm

- **Graph Algorithms**
  Connected component finding using Adjacency list and Adjacency matrix;
  Find shortest path between given source and destination using Dijkstra’s algorithm;
  Find minimum spanning tree using Kruskal’s algorithm;
  Find minimum spanning tree using Prim’s algorithm

- **Dynamic Programming**
  Find optimal ordering of matrix multiplication

- **Backtracking**
  8 Queens Problem
Course code | Course Name | L-T-P-Credits | Year of Introduction
---|---|---|---
IT301 | Software Architecture and Design Patterns | 3-1-0 - 4 | 2016

Prerequisite : Nil

Course Objectives
- To introduce to the students the basic knowledge of software, software development process and the concepts of software design principles.
- Gain knowledge on how to design UML diagrams.
- To impart knowledge on the different architectural styles and architectural patterns for the software.

Syllabus

Expected outcome
The students will be able to
i. Design UML diagram for the software.
ii. Identify and apply appropriate architectural styles and architectural design pattern for the software.
iii. Create flexible, reusable and efficient architecture for software.

Reference Books:
2. Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides : Design Patterns: Elements of Reusable Object-Oriented Software, Addison – Wesley, 1994
3. James Rumbaugh, Object Oriented Modeling and Design, Prentice Hall India
4. Len Bass, Paul Clements, Rick Kazman, Software Architecture in Practice (2nd Ed.), Pearson

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Software Design principles – Correctness and Robustness – Flexibility, Reusability and Efficiency – Tradeoffs among robustness, flexibility, reusability and efficiency</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
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</table>

**FIRST INTERNAL EXAM**

<table>
<thead>
<tr>
<th>III</th>
<th>Introduction to UML diagrams – Use case diagrams, Class diagrams, Sequence diagrams, Activity diagrams, State Transition diagram, Deployment diagram.</th>
<th>8</th>
<th>15%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Case study discussion on UML diagrams – Group presentation by students on different case studies.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Software architectural styles - pipes &amp; filters, layered, event-based, data-centered, interpreter, MVC, message dispatcher, multi-tier distributed</td>
<td>9</td>
<td>15%</td>
</tr>
</tbody>
</table>

**SECOND INTERNAL EXAM**

| V | What is a design pattern? Creational patterns – Factory, Abstract Factory, Prototype and Singleton. Structural patterns – Composite, Decorator, Adapter, Façade and Flyweight. | 9 | 20% |
| VI | Behavioral patterns- Chain of responsibility, Command, Interpreter, Mediator, State, Template and Observer. Evaluation of architectural design - ATAM | 9 | 20% |

**END SEMESTER EXAM**

**QUESTION PAPER PATTERN**

Maximum Marks: 100  
Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note**: Each question can have a maximum of 4 subparts, if needed
<table>
<thead>
<tr>
<th>Course code</th>
<th>Name</th>
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<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT302</td>
<td>Internet Technology</td>
<td>4-0-0-4</td>
<td>2016</td>
</tr>
</tbody>
</table>

Prerequisite: Nil

Course Objective

- To impart the basics of web page design
- To understand important components of HTML5 documents and use HTML5 to create web pages
- To learn to use JavaScript in Webpages to enhance the functionality and appearance of web pages
- To know XML schema and transformation
- To design dynamic web pages using PHP

Syllabus


Expected Outcomes

After the course the students would be able to

i. analyze and apply the role of languages like HTML, CSS, XML, Javascript, PHP and the workings of the web and web applications
ii. analyze a web project and identify its elements and attributes in comparison to traditional projects.
iii. analyze and create web pages using HTML, and Cascading Style sheets.
iv. analyze and build dynamic web pages using JavaScript (client side programming).
v. analyze and create XML documents and XML Schema.
vi. analyze and build interactive web applications using PHP

TEXT BOOK


REFERENCES

4. www.w3schools.com
<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction to Computers and the Internet- Web Basics, Introduction to HTML5 - W3C HTML5 Validation Service, Headings, Linking, Images, Special Characters and Horizontal Rules, Lists, Tables, Forms, Internal Linking, meta elements, New HTML5 Form input Types, input and data list elements and autocomplete Attribute, Page-Structure Elements.</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Introduction to Cascading Style Sheets - Inline Styles, Embedded Style Sheets, Conflicting Styles, Linking External Style Sheets, Positioning Elements - Absolute Positioning, z-index, Relative Positioning, span, Backgrounds, Element Dimensions, Box Model and Text Flow, Media Types, Drop-Down Menus</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>JavaScript: Introduction to Scripting - Control Statements - if Selection Statement, if...else Selection Statement, while Repetition Statement, for Repetition Statement, switch Multiple-Selection Statement, do...while Repetition Statement, break and continue Statements, JavaScript: Functions - Function Definitions, Random Number Generation, JavaScript Global Functions, JavaScript: Arrays - Declaring, Allocating and Using Arrays, Passing Arrays to Functions, Sorting Arrays with sort, Searching Arrays with index Of, JavaScript: Objects: Math, String, Date, Boolean and Number, document Object.</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Document Object Model (DOM): Modeling a Document: DOM Nodes and Trees, Traversing and Modifying a DOM Tree, DOM Collections, Dynamic Styles, Using a Timer and Dynamic Styles to Create Animated Effects, JavaScript Event Handling: load Event, Event mouse move and the event Object, Form Processing with focus and blur, submit and reset, Event Bubbling</td>
<td>6</td>
<td>15%</td>
</tr>
</tbody>
</table>

FIRST INTERNAL EXAMINATION

SECOND INTERNAL EXAMINATION
|---|---|---|---|

END SEMESTER EXAM

QUESTION PAPER PATTERN

Maximum Marks: 100

Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note**: Each question can have a maximum of 4 subparts, if needed
Course No. | Course Name | L-T-P - Credits | Year of Introduction
--- | --- | --- | ---
IT303 | Theory of Computation | 3-0-0-3 | 2016

Pre-requisites: Nil

Course Objectives
- To study computing machines and their capabilities
- To impart the basic concepts of theory of automata, languages and computation.
- To develop a model for that computers manipulate the data.
- To develop understanding about machines for sequential recognition and computation
- To understand and classify formal languages and grammars

Syllabus
Introduction: Formal representation of languages – Chomsky Classification, Introduction to Automata theory, NFA , DFA, Regular Expressions,–Conversion of NFA to DFA – Finite automata with output-Moore and Mealy machines– Finite Automation with ε-Transitions Minimisation of DFA-DFA to Regular Expressions conversion, Applications of finite automata, Context Free Grammar – Derivation trees, ambiguity, simplification of CFLs, normal forms of CFGs. PDA – formal definition, examples of PDA, Deterministic PDA. Pumping lemma for CFGs, closure properties of CFLs, decision algorithms for CFGs. Turing machines, formal definition of Turing Machine, language acceptability by TM, examples of TM. Variants of TMs – multitape TM, Non-deterministic TM, offline TMs, equivalence of single tape and multitape TMs.

Module – IV Recursive and recursively enumerable languages – properties recursive and r.e. languages. Decidability - decidable and undecidable problems, Universal Turing Machine, halting problem, reducibility

Expected outcome.
- The student will be able to model different automata that accepts appropriate languages.

Text Book:

References:
1. John Martin, Introduction to Language and Theory of Computation, TMH
2. K.V.N. Sunitha and N Kalyani, Formal languages and Automata Theory Tata McGraw Hill, NewDelhi,
5. Peter Linz, An Introduction to Formal Languages and Automata Narosa Publication

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction: Formal representation of languages – Chomsky Classification, Introduction to Automata theory, Alphabets and Languages, language operations: Concatenation, sub string Kleene closure, Reversal, Finite state systems, Transition diagram and table</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Finite automata, Finite state automata – description of finite automata, language acceptability, designing finite automata, NFA, - Difference between NFA&amp;DFA finite automata with epsilon</td>
<td>8</td>
<td>15%</td>
</tr>
<tr>
<td>Part</td>
<td>Module</td>
<td>Topics</td>
<td>Questions</td>
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</tr>
<tr>
<td>II</td>
<td>III</td>
<td>Conversion of NFA to DFA - Minimisation of DFA, Applications of finite automata, Finite Automata with output, Moore and Mealy Machines.</td>
<td>6</td>
</tr>
<tr>
<td>III</td>
<td>Regular Expressions – Properties of Regular sets, Ardens theorem, DFA to Regular Expressions conversion, DFA construction for given regular expression, Pumping Lemma, closure properties.</td>
<td>8</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Context Free Grammar – Derivation trees, ambiguity, simplification of CFLs, normal forms of CFGs, Chomsky and Greibach NFs, PDA – formal definition, examples of PDA, language acceptability, Deterministic PDA, Pumping lemma for CFGs, Applications of PDA and CFLs</td>
<td>8</td>
<td>20%</td>
</tr>
<tr>
<td>V</td>
<td>Turing machines - Chomsky classification of languages, formal definition of Turing Machine, language acceptability by TM, examples of TM, Variants of TMs – multitape TM, multiple tracks, checking off symbols, Subroutines, Non-deterministic TM, offline TMs, Universal Turing Machine, equivalence of single tape and multitape TMs.</td>
<td>6</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>Linear bounded automata, Recursive and recursively enumerable languages – properties recursive and r.e. languages, Decidability - decidable and undecidable problems, tractable and intractable problems, halting problem, reducibility, Church Thesis</td>
<td>6</td>
<td>20%</td>
</tr>
</tbody>
</table>

**END SEMESTER EXAM**

**QUESTION PAPER PATTERN**

Maximum Marks: 100

Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note**: Each question can have a maximum of 4 subparts, if needed
Course code: IT304

Course Name: Data Warehousing and Mining

L-T-P - Credits: 3-0-0-3

Year of Introduction: 2016

Prerequisite: CS208 Principles of data base design

Course Objectives:
- To understand Data Mining, its origin, taxonomy and applications
- To understand types of data and to improve the quality of data and efficiency and the ease of the mining process.
- To understand the supervised learning that is Classification, its applications and approaches
- To understand how to identify associations among objects and to learn various algorithms to find them
- To understand methods and need for finding complex Association Rules
- To learn the unsupervised learning to identify the relation among the objects and to understand applications and algorithms for Clustering

Syllabus
Data Mining, Applications, Data Mining Models, Data Warehousing and OLAP, Challenges, Tools, Data Mining Principles, Data Preprocessing: Data Preprocessing Concepts, Data Visualization, Data Sets and Their Significance, Classification Models, Multi Resolution Spatial Data Mining, Classifiers, Association Rules Mining, Cluster Analysis, Practical Data Mining Tools, Advanced Data Mining Techniques, Web Mining, Text Mining, CRM Applications and Data Mining, Data warehousing.

Expected outcome:
- The student will understand the concept of data mining, association rule mining and data classification methods

Text Book:

References:

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Data Mining: Concepts: Concepts; Data Mining Applications, Data Mining Stages, Data Mining Models, Data Warehousing and OLAP, Need for Data Warehousing, Challenges, Application of Data Mining Principles, Machine Learning and Statistics, Ethics of Data Mining, Popular Tools, OLTP Vs DWH, Applications of DWH</td>
<td>8</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Data Preprocessing: Data Preprocessing Concepts, Data Cleaning, Handling Missing Data, Data Transformation and Discretization, Data Visualization. UCI Data Sets and Their Significance</td>
<td>6</td>
<td>15%</td>
</tr>
</tbody>
</table>

FIRST INTERNAL EXAMINATION

<p>| III    | Classification Models: Introduction to Classification Models, | 6     | 15%             |</p>
<table>
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</thead>
<tbody>
<tr>
<td>IV</td>
<td>Decision Tree, Neural Networks, Naive Bayes Classifier, Support Vector Machines. Prediction Models, Issues regarding classification and prediction.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>V</td>
<td>SECOND INTERNAL EXAMITION Association Rules Mining: Concepts, Apriori Algorithm, Cluster Analysis: Introduction, Concepts, K-Means Clustering, Density-Based Clustering, Weighted Graph Partitioning, Hypergraph Partitioning.</td>
<td>8</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>Practical Data Mining Tools: Weka, R Package for Data Mining. Advanced Data Mining Techniques: Introduction, Web Mining- Web Content Mining, Web Structure Mining, Web Usage Mining, Text Mining, CRM Applications and Data Mining, CRM Data Mining Models. Data Warehousing with Oracle BI</td>
<td>7</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>END SEMESTER EXAM</td>
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</tbody>
</table>

**QUESTION PAPER PATTERN**

Maximum Marks: 100  
Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note**: Each question can have a maximum of 4 subparts, if needed.
<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Name</th>
<th>L-T-P - Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT305</td>
<td>Operating systems</td>
<td>3-0-0:3</td>
<td>2016</td>
</tr>
</tbody>
</table>

Pre-requisites: C202 Computer Organization and Architecture

Course Objectives
- To provide basic knowledge of computer operating system structures and functioning.
- To understand the fundamental concepts, processes and communication
- To understand and analyse implementation of: process synchronization
- To know design issues associated with operating systems
- To familiarise with memory management including virtual memory

Syllabus

Expected outcome:
- The student will understand the functions of operating System, system interactions with other parts of computer.

Text Books:

References:

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction: Operating Systems – Batch, Multi programmed, Time-sharing and Real time systems - System calls – System Programs — Simple structure, Layered approach – Kernel, Shell.</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Processes-. Process Scheduling - Round Robin Scheduling – Priority scheduling -multiple queues - Shortest Job First - Guaranteed scheduling - Two- level scheduling. Preemptive scheduling, Dispatcher –Multiple-processor scheduling.</td>
<td>8</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>Inter process Communication -Race Conditions - Critical Sections – Mutual Exclusion - Busy Waiting - Sleep And Wakeup - Semaphores - Event Counters - Monitors - Message Passing</td>
<td>6</td>
<td>15%</td>
</tr>
</tbody>
</table>
IV  Memory management: Basics - swapping - fixed partitions - variable partitions - overlay - paging - segmentation - segmented paging - virtual memory concepts - demand paging - page replacement - space allocation policies - dynamic linking - Thrashing  7  15%

SECOND INTERNAL EXAMINATION

V  Device management: Physical characteristics – disk scheduling algorithms - sector queuing - device drivers. Dead locks: Deadlock characteristics - conditions for deadlock - prevention - avoidance - detection – recovery from deadlock - bankers algorithm - resource trajectories - starvation.  8  20%

VI  File System: File concept - Access methods – Directory structure – Directory implementation – Linear list, Hash table – Case study: Linux system.  7  20%

END SEMESTER EXAM

QUESTION PAPER PATTERN

Maximum Marks: 100  Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

Part A shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

Part B shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

Part C shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

Note: Each question can have a maximum of 4 subparts, if needed
Course code | Course Name | L-T-P - Credits | Year of Introduction
--- | --- | --- | ---
IT306 | Distributed Systems | 3-0-0-3 | 2016

Pre-requisites: IT305 Operating Systems

Course Objectives:
- To understand the concepts that underlie distributed computing systems along with design and implementation issues.
- To study the key mechanisms and models for distributed systems.

Syllabus
Introduction to distributed systems, inter process communication, distributed files systems, Name service, Time and global states, election algorithms, distributed files systems and case study.

Expected Outcome:
The students will
i. gain a clear understanding of the concepts that underlie distributed computing systems along with design and implementation issues.
ii. use key mechanisms and models for distributed systems including logical clocks, causality, vector timestamps, and election algorithms.

Text Books:

References:

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
</table>
Distributed Objects and Remote Invocation-Introduction
Communication between distributed objects-Remote procedure calls
Events and notifications-Case study: Java RMI.
Operating System Support-Introduction-OS layer-Protection-Processes and threads- Communication and invocation OS architecture.

FIRST INTERNAL EXAMINATION

Distributed File Systems-Introduction-File service architecture-Case Study: Sun Network File System-Enhancements and further developments.
Name Services-Introduction-Name Services and the Domain Name System-Directory Services-Case Study: Global Name Service

SECOND INTERNAL EXAMINATION

Coordination and Agreement-Introduction-Distributed mutual exclusion – Elections → Multicast communication-Consensus and related problems.

END SEMESTER EXAM

QUESTION PAPER PATTERN

Maximum Marks: 100
Exam Duration: 3 hours
The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note:** Each question can have a maximum of 4 subparts, if needed
<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P - Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT307</td>
<td>Computer Networks</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** Nil

**Course Objectives**
- To understand the concepts of Computer networks, its applications, types and Network Software & Hardware.
- To know the various Data Link Layer protocols.
- To study the congestion control algorithms in Network Layer
- To understand the application layer protocols HTTP, FTP, SMTP, P2P, DNS

**Syllabus**

**Expected outcome**
- The students will be able to use different types of computer networks to interconnect a distributed community of computers and various interfacing standards and protocols.

**Text Book:**

**References:**

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td><strong>Data Link Layer:</strong> - Data link Layer design issues-Error Detection and correction – Elementary Data link protocols- Sliding window protocols- Basic Concept, One Bit Sliding window protocol, Concept of Go Back n and Selective repeat.</td>
<td>6</td>
<td>15%</td>
</tr>
</tbody>
</table>
### FIRST INTERNAL EXAMINATION

<table>
<thead>
<tr>
<th>Module</th>
<th>Topics</th>
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</table>

### SECOND INTERNAL EXAMINATION

<table>
<thead>
<tr>
<th>Module</th>
<th>Topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI</td>
<td>Application Layer: HTTP- Overview, Persistent and non persistent Connections, Message formats, Concept of Cookies and Web Cache -FTP - Electronic Mail – SMTP, Mail message formats, POP3, IMAP – DNS- Services provided by DNS, Overview of how DNS works, DNS Caching, Message format - P2P File sharing</td>
</tr>
</tbody>
</table>

### END SEMESTER EXAM

#### QUESTION PAPER PATTERN

<table>
<thead>
<tr>
<th>Maximum Marks</th>
<th>Exam Duration</th>
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<tbody>
<tr>
<td>100</td>
<td>3 hours</td>
</tr>
</tbody>
</table>

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note**: Each question can have a maximum of 4 subparts, if needed.
Prerequisite: CS305 Microprocessors & microcontrollers

Course Objectives
- To study assembly language programming in 8051.
- To study interfacing of various peripherals using 8051.
- To design and develop applications using 8051.

List of Exercises / Experiments (Minimum of 9 mandatory out of 11)

Programming experiments using 8051 Trainer Kit.
1. Familiarization of 8051 Microcontroller Kit
2. Addition and Subtraction of 16 bit numbers.
3. Multiplication and division of 8 bit numbers.
4. Sorting, Factorial of a number.
5. LCM and HCF of two 8 bit numbers
7. DAC interface
8. Display interface.
10. Frequency measurement by counting the number of pulses in a fixed amount of time.
11. Frequency measurement by measuring the time period between two consecutive pulses.

Class Project (Minimum one mandatory per group)
1. Liquid/Level indicator with Alarm using 8051 microcontroller
2. Interfacing Keyboard with 8051 microcontroller
3. Digital Clock with 8051 microcontroller

Expected Outcome
- The students will be able to develop a system using 8051 microcontroller

References
- Muhammad Ali Mazidi, The 8051 microcontroller and Embedded System
- Kenneth Ayala, The 8051 Microcontroller
- 3Scott, The_8051_Microcontroller.

Websites:
- www.8051projects.info
- www.engineersgarage.com
- www.mikroe.com
- www.8052.com

For development tools:
- www.keil.com
- www.atmel.com
Course code | Course Name       | L-T-P- Credits | Year of Introduction |
------------|------------------|----------------|----------------------|
IT333       | Database Lab     | 0-0-3-1        | 2016                 |

Prerequisite: CS208 Principles of database design

Course Objectives
- To provide a hands-on experience in database management concepts.
- To provide a strong formal foundation in database concepts, technology and practice to the students.
- To present SQL and procedural interfaces to SQL comprehensively.
- To declare and enforce integrity constraints on a database using a state-of-the-art RDBMS.

List of Exercises / Experiments (Minimum of 8 mandatory out of 10)
1. Familiarization of creation of databases and SQL commands (DDL, DML and DCL).
2. Suitable exercises to practice SQL commands may be given for Insert, Update, Delete etc.
3. Write SQL procedure for an application which uses exception handling.
4. Write SQL procedure for an application with cursors.
5. Write SQL for implementing Nested Queries.
6. Write SQL for implementing Join Queries.
7. Write a DBMS program to prepare reports for an application using functions.
8. Write SQL block containing triggers.
9. Write SQL block containing stored procedures.
10. Develop a menu driven, GUI-based database application in any one of the domains such as Banking, Billing, Library management, Payroll, Insurance, Inventory, Healthcare etc. integrating all the features specified in the above exercises.

Class Project (Minimum one mandatory per group)
- Implementation of Hospital Management System
- Implementation of Student Management Systems
- Implementation of any Reservation Systems (Bus, Train, Railway etc…)

Expected Outcome
- The students will be able to design, understand, appreciate and effectively explain the underlying concepts of database technologies and thereby design and implement a database schema for a given problem-domain.

References
2. Atul Kahate, Introduction to Database Management Systems, Pearson ...
<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P-Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT334</td>
<td>Computer Networks Lab</td>
<td>0-0-3-1</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite**: IT307 Computer networks

**Course Objectives**
- To implement important computer networking protocols.
- To manage Layer2 switching service.
- To configure Virtual LANs and access control list.
- To troubleshoot an internetwork.

**List of Exercises / Experiments** (Minimum of 9 mandatory out of 11)

**INTERNETWORKING BASICS**

**IP ROUTING**
2. Implementing static routing.
3. Implementing dynamic routing using RIP.
4. Implementing dynamic routing using OSPF.
5. Implementing dynamic routing using EIGRP.

**VIRTUAL LANS**
7. VTP Configuration, VTP pruning.
8. Implement inter-VLAN routing.

**SECURITY**
9. Access Control List
   b. Extended Access Lists.

**MANAGING A INTERNETWORK**
10. Backup and restoring IOS.
11. Familiarization of network simulators.

**Class Project** (Minimum one mandatory per group)
   i. Implementation of an organizations network with security using any routing protocols.
   ii. Implementation of network using VLAN and configure inter-vlan communication

**Expected Outcome**
The students will be able to
   i. configure a network using routing protocols and VLAN
   ii. manage a internetwork

**References**
<table>
<thead>
<tr>
<th>Course code</th>
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<th>L-T-P- Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT361</td>
<td>Graph Theory</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** Nil

**Course Objectives**
1. To understand and apply the fundamental concepts in graph theory
2. To apply graph theory based tools in solving practical problems
3. To improve the proof writing skills.

**Syllabus**

**Expected outcome**.
- The students will be able to apply principles and concepts of graph theory in practical situations

**References:**

**Course Plan**

<table>
<thead>
<tr>
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<th>Contents</th>
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</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>GRAPHS AND SUBGRAPH - Graphs and Simple Graphs, Graph Isomorphism, The Incidence and Adjacency Matrices, Subgraphs, Vertex Degrees, Paths and Connection, Cycles, Applications – The Shortest Path Problem, Sperner's Lemma . TRES - Cut Edges and Bonds, Cut Vertices, Cayley's Formula, Applications - The Connector Problem</td>
<td>5</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>CONNECTIVITY - Blocks, Applications-Construction of Reliable Communication Networks Euler Tours, Hamilton Cycles, Applications-The Chinese Postman Problem, The Travelling Salesman Problem</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>VERTEX COLOURINGS - Chromatic Number, Brooks' Theorem, Hajas' Conjecture, Chromatic Polynomials, Girth and Chromatic Number, Applications - A Storage Problem</td>
<td>5</td>
<td>15%</td>
</tr>
<tr>
<td>V</td>
<td>Planar Graphs - Plane and Planar Graphs, Dual Graphs, Euler's Formula, Bridges, Muratowski's Theorem, The Five-Colour Theorem and the Four-Colour Conjecture, Nonhamiltonian Planar Graphs, Applications - A Planarity Algorithm</td>
<td>5</td>
<td>20%</td>
</tr>
</tbody>
</table>

FIRST INTERNAL EXAMINATION

SECOND INTERNAL EXAMINATION
Maximum Marks: 100
Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note:** Each question can have a maximum of 4 subparts, if needed.
## Course Details

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P - Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT362</td>
<td>Information Retrieval</td>
<td>3-0-0-3</td>
<td>2017</td>
</tr>
</tbody>
</table>

**Pre-requisites:** CS205 Data structures

### Course Objectives
- To provide with foundation knowledge in information retrieval.
- To equip with sound skills to solve computational search problems.

### Syllabus
Introduction to the Concepts of Information Retrieval, Retrieval models, Searching the web and Parallel and Distributed Information Retrieval systems.

### Expected outcome
The students will be able to:
- i. use different information retrieval techniques in various application areas
- ii. apply IR principles to locate relevant information large collections of data and analyse performance of retrieval systems when dealing with unmanaged data sources
- iii. implement retrieval systems for web search tasks.

### Text Books:
2. C.J. Van Rijsbergen, Information Retrieval; http://www.dcs.gla.ac.uk/Keith/Preface.html

### References:

### Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Classification, Measures of Association, Cluster Hypothesis, Single Link Clusters, File Structures, Inverted Files, Index Sequential Files, Ring Structures, Doubly Chained Trees, Hash Addressing.</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>

**FIRST INTERNAL EXAMINATION**

| III    | Evaluation, Relevance, Precision and Recall, Interpolation, Averaging techniques, The Swets Model. | 7     | 15%             |
| IV     | Search Engines, Boolean Search, Matching Functions, Serial Search, Cluster Representatives, Cluster based retrieval. | 7     | 15%             |

**SECOND INTERNAL EXAMINATION**

| V      | Web search basics – Web characteristics - crawling and indexes – Features of a crawler – Crawler architecture – DNS | 7     | 20%             |
The URL frontier – Distributing indexes – Connectivity servers.

VI


END SEMESTER EXAM

QUESTION PAPER PATTERN

Maximum Marks: 100

Exam Duration: 3 hours

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<tbody>
<tr>
<td>IT363</td>
<td>Unix Shell Programming</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Pre-requisites:** IT 201 *Operating Systems*

**Course Objectives**
- To learn the architecture UNIX and important features of UNIX.
- To familiarize the basic commands used in UNIX.
- To describe the TCP/IP networking tools used in UNIX.
- To familiarize the text processing utilities grep, sed, awk.
- To discuss the shell programming concept.
- To develop programs using shell script.

**Syllabus**
Introduction to UNIX, Architecture, features, Basic commands, utilities, editors, UNIX file system, UNIX shells, Pipes, tee command, filters, process in Unix, TCP/IP networking tools, usage of grep and sed, programming with awk, shell programming basics, shell programming constructs, advanced concepts in shell programming

**Expected outcome**
- To familiarize the UNIX operating system and the utilities for solving computing problems in a shell programming environment.

**Text Book:**

**References:**
1. Kernighan and Pike, “Unix programming environment”, PHI. / Pearson Education
2. Graham Glass, King Ables,” Unix for programmers and users”, 3rd edition, Pearson Education

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction to Unix:- Architecture of Unix, Features of Unix , Introduction to unix file system, Basic Unix Commands – General-purpose utilities, vi editor</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>The Unix file system – Parent-Child relationship – File types - File operations - File Permissions – File Ownership – File modification and access times – Directories – Directory permissions – File System and Inodes – Links and symbolic links – locating Files.</td>
<td>6</td>
<td>15%</td>
</tr>
</tbody>
</table>

**FIRST INTERNAL EXAMINATION**


SECOND INTERNAL EXAMINATION

| V | Filters using regular expressions – grep –sed – programming with awk – preliminaries, formatted output, variables, number processing, comparison operators, BEGIN and END sections, arrays, control flows, looping and functions. | 8 | 20% |

END SEMESTER EXAM

QUESTION PAPER PATTERN

Maximum Marks: 100
Exam Duration: 3 hours

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Note: Each question can have a maximum of 4 subparts, if needed
Course code | Course Name | L-T-P-Credits | Year of Introduction
--- | --- | --- | ---
IT364 | Software Project Management | 3-0-0-3 | 2016

**Course Objectives**

- To develop awareness regarding the theoretical and methodological issues related to software project management.
- To develop software projects based on current technologies.

**Syllabus**


**Expected Outcome**

After the successful completion of the course students will be able to

i. Identify the theoretical and methodological issues involved in modern software engineering project management

ii. Develop the transferable skills in logical analysis, communication and project management necessary for working within a team.

iii. Translate a specification to a design, and identify the components to build the architecture for a given problem, using an appropriate software engineering methodology.

iv. Select and use project management frameworks that ensure successful outcomes.

v. Develop software projects based on current technologies, by managing resources economically and keeping ethical values.

**References**


**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction to software engineering- scope of software engineering, historical aspects, economic aspects, maintenance aspects, specification and design aspects, team programming aspects. Layered technology, processes, methods and tools.</td>
<td>3</td>
<td>15%</td>
</tr>
<tr>
<td>Phases in Software development.</td>
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<td>---------------------------------</td>
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<td></td>
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<tr>
<td>Process models- prescriptive process models- waterfall model, incremental models, evolutionary models, and concurrent models. Specialised process models- component based development, formal methods model, aspect oriented software development. The unified process, personal and team process models.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Project management concepts- the management spectrum, people, product, process, and project.</td>
<td></td>
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</tr>
</tbody>
</table>

### FIRST INTERNAL EXAM

| Process and project metrics- software measurement- size oriented, function oriented, LOC and function point, metrics for software quality- measuring quality, defect removal efficiency, integrating metrics within the software process. |
| Estimation for software projects- project planning, software scope, resources. Software project estimation, decomposition techniques- Software Sizing, Problem-Based Estimation, Process-Based Estimation. |

### SECOND INTERNAL EXAM

| Software Configuration Management - An SCM Scenario, Elements of a Configuration Management System, Baselines, Software Configuration Items. The SCM Repository - The Role of the repository, General Features and Content, SCM Features. The SCM Process- Identification of Objects in the Software Configuration, Version Control, Change Control, and...

END SEMESTER EXAM

QUESTION PAPER PATTERN

Maximum Marks: 100
Exam Duration: 3 hours

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**Note**: Each question can have a maximum of 4 subparts, if needed
Course code | Course Name | L-T-P-Credits | Year of Introduction
--- | --- | --- | ---
IT365 | Computer Architecture & Parallel Processing | 3-0-0-3 | 2016

**Prerequisite:** Nil

**Course Objectives**
- To understand issues and techniques in improving performance of processors
- To understand the concepts of pipelining
- To familiarize with the properties of superscalar processors
- To understand the multiprocessor systems, multi core systems and the concept of cache coherence

**Syllabus**
Classes of parallelism and parallel architecture, computer architecture- design issues, Performance measurements, quantitative principles of computer design, Instruction level parallelism -concepts and challenges, Data dependencies and hazards, Basic compiler techniques for exposing ILP.Dynamic Scheduling- Tomasulo's approach, Hardware based speculation, ILP using multiple issue and static scheduling, ILP using dynamic scheduling-case study- Intel Core i7. Data level parallelism-Vector Architecture, Graphic processing unit, Centralized shared memory architecture, Multiprocessor cache coherence - Distributed shared memory, Schemes for enforcing coherence Interconnection Network Design, Designing Multicore Architectures -- Unique challenges in multicore architectures

**Expected Outcome**
The students will be to
1. Know design issues of processors and performance measurement of processors
2. Apply instruction level parallelism and data Level Parallelism
3. Understand Multiprocessor systems, cache coherence and Interconnection networks

**Text Books**

**References**
2. Research papers from top conferences such as ISCA, HPCA, MICRO, and ASPLOS.

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
</table>
## Computer architecture - design issues

| Memory wall, Power Wall, Classes of parallelism and parallel architecture, Performance measurements, Pipelining- Scalar and super scalar processors- Instruction level parallelism - concepts and challenges, ILP Wall |
|---|---|
| 4 | 15% |

## Data hazards, Structural Hazards, Branch Hazards, Branch Prediction schemes, Basic compiler techniques for exposing instruction-level parallelism. |
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<td>4</td>
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</table>

### FIRST INTERNAL EXAM

| Dynamic Scheduling- Tomasulo’s approach, Hardware based speculation. ILP using multiple issue and static scheduling, ILP using dynamic scheduling, multiple issue and speculation. Case study- Intel Core i7. Data level parallelism- Vector architecture- Vector instruction types, Vector-Access memory schemes, Graphic processing units. |
|---|---|
| 4 | 15% |

### SECOND INTERNAL EXAM

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### END SEMESTER EXAM

**QUESTION PAPER PATTERN**

Maximum Marks: 100

Exam Duration: 3 hours

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**Note**: Each question can have a maximum of 4 subparts, if needed.
Course code | Course Name                                      | L-T-P - Credits | Year of Introduction |
-------------|-------------------------------------------------|-----------------|----------------------|
IT366        | Advanced Database Management Systems            | 3-0-0-3         | 2016                 |

**Pre-requisites:** CS208 Principles of database design

**Course Objectives**
- To enable design of high-quality relational databases and database applications.
- To develop skills in advanced visual & conceptual modelling and database design.
- To make aware of emerging database trends as they apply to semi-structured data, the internet, and object-oriented databases.

**Syllabus**
Distributed Databases, Object Oriented Databases, Emerging Systems, Data mining and dataware housing, Database Design Issues, Current Issues.

**Expected outcome**
The students will be able
- To develop skills in advanced visual & conceptual modelling and database design.
- To develop an appreciation of emerging database trends as they apply to semi-structured data, the internet, and object-oriented databases.

**Text Book:**

**References:**

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
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</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Distributed Databases</strong>&lt;br&gt;Distributed Databases Vs Conventional Databases – Architecture – Fragmentation– Query Processing – Transaction Processing – Concurrency Control – Recovery.</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td><strong>Object Oriented Databases</strong>&lt;br&gt;Introduction to Object Oriented Data Bases - Approaches - Modelling and Design- Persistence – Query Languages - Transaction - Concurrency – Multi VersionLocks - Recovery.</td>
<td>8</td>
<td>15%</td>
</tr>
</tbody>
</table>

FIRST INTERNAL EXAMINATION
<table>
<thead>
<tr>
<th>III</th>
<th>Emerging Systems</th>
<th>Enhanced Data Models - Client/Server Model - Web Databases – Mobile Databases.</th>
<th>6</th>
<th>15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Data mining and data ware housing.</td>
<td>Data mining introduction-concepts-association-classification-clustering-applications Datawarehousing-introduction-architecture-characteristics-modeling and building data warehouse</td>
<td>6</td>
<td>15%</td>
</tr>
</tbody>
</table>

**SECOND INTERNAL EXAMINATION**

<table>
<thead>
<tr>
<th>V</th>
<th>Database Design Issues</th>
<th>ER Model - Normalization - Security - Integrity - Consistency - Database Tuning - Optimization and Research Issues – Design of Temporal Databases – Spatial Databases</th>
<th>8</th>
<th>20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI</td>
<td>Current Issues</td>
<td>Rules - Knowledge Bases - Active And Deductive Databases - Parallel Databases– Multimedia Databases – Image Databases – Text Database</td>
<td>8</td>
<td>20%</td>
</tr>
</tbody>
</table>

**END SEMESTER EXAM**

**QUESTION PAPER PATTERN**

Maximum Marks: 100
Exam Duration: 3 hours

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# Computer Graphics & Multimedia

<table>
<thead>
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<th>L-T-P-Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT367</td>
<td>Computer Graphics &amp; Multimedia</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** Nil

**Course Objectives**
- To build an understanding of the fundamental concepts of Computer Graphics & Multimedia
- To familiarize with the working principles of various display technologies.
- To prepare for understanding advanced courses in Computer Graphics.

**Syllabus**


**Expected Outcome**

The students will be able to

- i. Explain the techniques used for display in CRT, LCD, LED displays.
- ii. Identify the intermediate points needed to plot a line, given only its end points.
- iii. Write the matrix corresponding to various 2D & 3D transformations.
- iv. Find the vertices of the clipped polygon against a rectangular window by applying the learned polygon clipping algorithm.
- v. Write an algorithm for finding & labeling different regions in a digital image.

**References**


<table>
<thead>
<tr>
<th>Module</th>
<th>Course Plan</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Graphics Systems – Raster Scan &amp; Random Scan systems. Output Primitives – Line Drawing Algorithms (DDA, Bresenham), Circle generation algorithm. Filled Area Primitives – Scan Fill, Flood Fill, Boundary Fill. Inside outside tests.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Multimedia: Data Compression- Source, Entropy &amp; Hybrid Coding, Basic compression techniques, JPEG, H.261, MPEG, DVI.</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>

**FIRST INTERNAL EXAM**

<p>| III    | Display Technologies: Working principle behind CRT, LCD, Plasma, LED, OLED, AMOLED, E-Paper displays. | 6     | 15%             |</p>
<table>
<thead>
<tr>
<th>Module</th>
<th>Topics</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>2-Dimensional Geometric Transformations (Basic Transformations, Reflection &amp; Shear), Homogenous Matrix representation of transformations, Composite Transformations.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>V</td>
<td>2-D Clipping- Point Clipping, Cohen-Sutherland Line Clipping Algorithm, Sutherland-Hodgeman Polygon Clipping Algorithm. 3-Dimensional Geometric Transformations - Basic Transformations, Composite 3-D transformations.</td>
<td>8</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>Visible Surface Detection Methods: Back Face Detection, Depth Buffer, A-Buffer, Scan line, Depth sorting methods. Digital Image Processing: Histogram, Equalisation, Image Segmentation, Region Labeling.</td>
<td>7</td>
<td>20%</td>
</tr>
</tbody>
</table>

**SECOND INTERNAL EXAM**

**END SEMESTER EXAM**

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**QUESTION PAPER PATTERN**

Maximum Marks: 100

Exam Duration: 3 hours

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<tbody>
<tr>
<td>IT368</td>
<td>INFORMATION THEORY AND CODING</td>
<td>3-0-0.3</td>
<td>2016</td>
</tr>
</tbody>
</table>

Pre-requisites: NIL

Course Objectives
- To provide basic concepts of Information Theory
- To understand the design and analysis of coding/decoding scheme for digital Communication application

Syllabus
Information theory, discrete channels, continuous channels, source coding, Codes for error detection and correction, Convolution codes, Interleaving techniques, ARQ

Expected outcome
- The student will understand the design and analysis of coding/decoding scheme for digital communication application

References:

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
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</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Information theory: - Concept of amount of information - units, Entropy - marginal, conditional and joint entropies - relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels.</td>
<td>5</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Discrete channels: - Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, repetition of symbols, Binary unsymmetric channel, Shannon theorem.</td>
<td>5</td>
<td>15%</td>
</tr>
</tbody>
</table>

FIRST INTERNAL EXAMINATION

III
Continuous channels: - Capacity of band limited Gaussian channels, Shannon-Hartley theorem, Trade off between band width and signal to noise ratio, Capacity of a channel with infinite band width, Optimum modulation system.

IV

SECOND INTERNAL EXAMINATION
### Codes for error detection and correction
- Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes.
- Cyclic codes: Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.

### Convolutional codes
- Encoding: State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes, Viterby algorithm, Sequential decoding - Stack algorithm.

### Interleaving techniques
- Block and convolutional interleaving, Coding and interleaving applied to CD digital audio system - CIRC encoding and decoding, interpolation and muting.

### ARQ
- Types of ARQ, Performance of ARQ, Probability of error and throughput.

### END SEMESTER EXAM

**QUESTION PAPER PATTERN**

Maximum Marks: 100  
Exam Duration: 3 hours

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Course code  |  Course Name  |  L-T-P - Credits  |  Year of Introduction  
---|---|---|---
IT401  |  Embedded Systems  |  4-0-0-4  |  2016  

Prerequisite: Nil

Course Objectives
- To understand the fundamental concepts in Embedded Systems, Real Time Operating Systems, Arduino and Raspberry Pi
- To impart Embedded System Design Techniques

Syllabus

Expected outcome
- The students will acquire conceptual understanding in embedded systems, real time operating systems, Arduino, Raspberry Pi and the ability to apply them in practical situations.

References:
4. Peter Barry, Patrick Crowley, “Modern Embedded Computing”, Morgan Kaufmann

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRST INTERNAL EXAMINATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Raspberry Pi – Introduction, Python and Raspberry Pi, Arduino and Raspberry Pi, Basic Input and Output</td>
<td>9</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Embedded System Design Techniques – Design Methodologies, Requirements Analysis, Specifications, System Analysis and Architecture Design, Quality Assurance, Design Examples</td>
<td>9</td>
<td>15%</td>
</tr>
<tr>
<td>SECOND INTERNAL EXAMINATION</td>
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</tr>
</tbody>
</table>
Maximum Marks: 100

Exam Duration: 3 hours

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<tbody>
<tr>
<td>IT402</td>
<td>Cryptography &amp; Cyber Security</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** CS201 Discrete computational structures

**Course Objectives**
- To understand the mathematics behind Cryptography.
- To understand the security concerns and vulnerabilities
- To familiarize with different types of cryptosystems
- To create an awareness for the design of various cryptographic primitives
- To analyze different types of attacks on various cryptosystems.

**Syllabus**
Basics of Algebra and number theory – Security goals, services and mechanisms – cryptography -
traditional and modern secret key ciphers – data encryption standard – advanced encryption standard – public key crypto systems - digital signature – IP security

**Expected outcome .**
The students will be able
- To learn the importance of number theory in designing crypto systems;
- To design public and private key cryptosystems;
- To do cryptanalysis of various cryptosystems.

**Text Books:**

**References:**

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td><strong>Basics of Algebra and Number Theory:</strong> Integer Arithmetic- Modular Arithmetic- Algebraic structures – Prime Numbers - Fermat’s and Euler’s Theorem – Factorization - Chinese Remainder Theorem - Linear and Quadratic Congruence - Discrete Logarithms.</td>
<td>7</td>
<td>15%</td>
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</tbody>
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<thead>
<tr>
<th>FIRST INTERNAL EXAMINATION</th>
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<tbody>
<tr>
<td>III</td>
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<tr>
<td>IV</td>
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<tr>
<th>SECOND INTERNAL EXAMINATION</th>
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<tbody>
<tr>
<td>V</td>
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<tr>
<td>VI</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>END SEMESTER EXAM</th>
</tr>
</thead>
</table>

QUESTION PAPER PATTERN

Maximum Marks: 100
Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note:** Each question can have a maximum of 4 subparts, if needed
<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P - Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT403</td>
<td>Mobile Computing</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** Nil

**Course Objectives**
- Learn the basics of Mobile computing.
- Learn networking concepts relevant to modern wireless systems.
- Learn emerging mobile computing ideas and best practices.
- Get hands-on knowledge practice with mobile computing.

**Syllabus**


**Expected outcome**

The students will be able to
i. gain a sound understanding of the key components and technologies involved
ii. get hands-on experiences in setting up wired as well as wireless networks.
iii. describe the major techniques involved in mobile communication.
iv. Design and implement mobile network systems

**References:**
5. William Stallings, Wireless Communications and Networks, Pearson Education.

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>GSM- System Architecture-Protocols-Connection Establishment-Frequency Allocation-Routing-Handover-Security, GPRS</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>Mobile Network Layer : Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP).</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>
IV | Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP. | 7 | 15%

V | Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs. | 7 | 20%


END SEMESTER EXAM

QUESTION PAPER PATTERN

Maximum Marks: 100 | Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

Part A shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

Part B shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

Part C shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

Note: Each question can have a maximum of 4 subparts, if needed
Course code | Course Name        | L-T-P - Credits | Year of Introduction |
---|-------------------|-----------------|---------------------|
IT404       | Data Analytics    | 3-0-0-3         | 2016                |

Prerequisite: CS208 Principles of database design

Course Objectives
- To understand the data analysis techniques
- To understand the concepts behind the descriptive analytics and predictive analytics of data
- To familiarize with Big Data and its sources
- To familiarize data analysis using R programming
- To understand the different visualization techniques in data analysis

Syllabus
Data Analysis, Analysis Vs Reporting, Different Statistical Techniques of Data Analysis, Descriptive Analytics, Regressive Models, Neural Networks. Descriptive Analytics - Association and Sequential Rules, Big Data and its characteristics, Data Analysis using R language, Data visualization techniques.

Expected outcome:
- The student will understand the techniques to analyze different types of data, characterize it and can apply them to make decision modeling process more intelligent

Text Book:

References:

Course Plan

<table>
<thead>
<tr>
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<th>Contents</th>
<th>Hours</th>
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</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction to Data Analysis - Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools. Statistical concepts: Sampling distributions, re-sampling, statistical inference, prediction error.</td>
<td>8</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Predictive Analytics – Regression, Decision Tree, Neural Networks. Dimensionality Reduction - Principal component analysis</td>
<td>6</td>
<td>15%</td>
</tr>
</tbody>
</table>

FIRST INTERNAL EXAMINATION
### III
- Descriptive Analytics - Mining Frequent itemsets - Market based model – Association and Sequential Rule Mining - Clustering Techniques – Hierarchical – K- Means

| III | Descriptive Analytics - Mining Frequent itemsets - Market based model – Association and Sequential Rule Mining - Clustering Techniques – Hierarchical – K- Means | 6 | 15% |

### IV
- Introduction to Big data framework - Fundamental concepts of Big Data management and analytics - Current challenges and trends in Big Data Acquisition

| IV | Introduction to Big data framework - Fundamental concepts of Big Data management and analytics - Current challenges and trends in Big Data Acquisition | 7 | 15% |

### SECOND INTERNAL EXAMINATION
- Data Analysis Using R - Introduction to R, R Graphical User Interfaces, Data Import and Export, Attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis, Visualization Before Analysis, Dirty Data, Visualizing a Single Variable, Examining Multiple Variables, Data Exploration Versus Presentation, Statistical Methods for Evaluation

| V | Data Analysis Using R - Introduction to R, R Graphical User Interfaces, Data Import and Export, Attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis, Visualization Before Analysis, Dirty Data, Visualizing a Single Variable, Examining Multiple Variables, Data Exploration Versus Presentation, Statistical Methods for Evaluation | 8 | 20% |

- Popular Big Data Techniques and tools- Map Reduce paradigm and the Hadoop system- Applications Social Media Analytics- Recommender Systems- Fraud Detection.

| VI | Popular Big Data Techniques and tools- Map Reduce paradigm and the Hadoop system- Applications Social Media Analytics- Recommender Systems- Fraud Detection. | 7 | 20% |

### END SEMESTER EXAM

#### QUESTION PAPER PATTERN

**Maximum Marks: 100**  
**Exam Duration: 3 hours**

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

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**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note:** Each question can have a maximum of 4 subparts, if needed
Course code  | Course Name                   | L-T-P - Credits | Year of Introduction |
-------------|------------------------------|-----------------|----------------------|
IT405        | Internetworking with TCP/IP  | 3-0-0-3         | 2016                 |

Prerequisite : Nil

Course Objectives
- To understand the fundamental concepts in Internetworking, Internet Addressing, IP, UDP, and TCP Protocols, Routing Architecture, Network Virtualization and Software Defined Networking

Syllabus

Expected outcome .
2. Ability to apply the networking technologies in practical situations

References:

Course Plan

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction and Overview, Overview Of Underlying Network Technologies, Internetworking Concept And Architectural Model, Protocol Layering Internet Addressing, Mapping Internet Addresses To Physical Addresses (ARP), Internet Protocol: Connectionless Datagram Delivery (IPv4, IPv6) CIDR Sub netting</td>
<td>10</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Internet Protocol: Forwarding IP Datagrams, Internet Protocol: Error And Control Messages (ICMP), User Datagram Protocol (UDP)</td>
<td>4</td>
<td>15%</td>
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</tbody>
</table>

FIRST INTERNAL EXAMINATION

<table>
<thead>
<tr>
<th>Module</th>
<th>Topics</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Autonomous System (RIP, RIPng, OSPF, IS-IS), Internet Multicasting, Label Switching, Flows, And MPLS, Packet Classification</td>
<td>5</td>
<td>15%</td>
</tr>
<tr>
<td>V</td>
<td>Mobility And Mobile IP, Network Virtualization: VPNs, NATs, And Overlays, Bootstrap And Auto configuration (DHCP, NDP, Ipv6-ND), Voice And Video Over IP (RTP, RSVP, QoS)</td>
<td>7</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>Software Defined Networking (SDN, OpenFlow)</td>
<td>6</td>
<td>20%</td>
</tr>
</tbody>
</table>

**SECOND INTERNAL EXAMINATION**

**END SEMESTER EXAM**

**QUESTION PAPER PATTERN**

Maximum Marks: 100  
Exam Duration: 3 hours  

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**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note**: Each question can have a maximum of 4 subparts, if needed.
Course code | Course Name | L-T-P - Credits | Year of Introduction
--- | --- | --- | ---
IT407 | Knowledge Engineering | 3-0-0-3 | 2016

**Prerequisites:** CS205 Data structures.

**Course Objectives**
To enable the students:

- To get introduced to the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence.
- To solve problems in Artificial Intelligence using Python.
- To familiarize with Fuzzy Logic and knowledge processing in expert systems.

**Syllabus**
Introduction to the Concepts of Artificial Intelligence, Search Space, Knowledge Representation, Learning Techniques, Fuzzy systems and expert systems.

**Expected outcome**
The students will

i. know the fundamental concepts of Artificial Intelligence such as knowledge representation, problem solving, fuzzy set and expert systems

ii. will be able to implement search methods using Python.

**Text Books:**

**References:**

**Course Plan**

<table>
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<th>Module</th>
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<tbody>
<tr>
<td>I</td>
<td><strong>Problems and Search:</strong> What is Artificial Intelligence, The AI Problems, Defining the Problem as a State Space Search, Problem Characteristics Searching strategies – Generate and Test, Heuristic Search Techniques- Hill climbing– issues in hill climbing. <strong>Python</strong>-Introduction to Python- Lists Dictionaries &amp; Tuples in Python- Python implementation of Hill Climbing.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td><strong>Search Methods</strong> - Best First Search - Implementation in Python - OR Graphs, The A* Algorithm, Problem Reduction- AND-OR Graphs, The AO* algorithm, Constraint Satisfaction. MINIMAX search procedure, Alpha–Beta pruning.</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>

**FIRST INTERNAL EXAMINATION**
### Knowledge representation - Using Predicate logic -
representing facts in logic, functions and predicates,
Conversion to clause form, Resolution in propositional logic,
Resolution in predicate logic, Unification.
Representing Knowledge Using Rules: Procedural Versus
Declarative knowledge, Logic Programming, Forward versus
Backward Reasoning.

### Learning: What is learning, Rote learning, Learning by Taking
Advice, Learning in Problem-solving, Learning from example:
induction, Explanation-based learning.

### Connectionist Models: Hopfield Networks, Learning in
Neural Networks, Applications of Neural Networks, Recurrent
Networks. Connectionist AI and Symbolic AI

### Expert System – Representing and using Domain Knowledge –
Reasoning with knowledge – Expert System Shells – Support for
explanation- examples – Knowledge acquisition-examples.

## QUESTION PAPER PATTERN

Maximum Marks: 100  
Exam Duration: 3 hours

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**Note:** Each question can have a maximum of 4 subparts, if needed.
Course Code | Course Name | L-T-P-Credits | Year of Introduction
---|---|---|---
IT409 | Web Application Development | 3-0-0-3 | 2016

**Course Objectives**
- To give insights of the Internet programming for designing and implementation
- To develop code to handle exceptions and validate data for file and database storage.
- To know usage of recent platforms used in developing web applications such as J2EE, XML ...etc.
- To impart the idea about java beans.

**Syllabus**
Introduction - Web architecture - web application lifecycle - XML and J2EE. Servlets, Servlets with JDBC, JDBC: Architecture - JDBC API, Java Server Pages - Using JavaBeans Components in JSP Pages, Sharing Data Between JSP pages - Passing Control and Data between Pages – Sharing Session and Application Data – Application Models - MVC Design, Enterprise - Managed Persistence (CMP) and bean managed - lifecycle of EJB - Java Message Service (JMS) and Message Driven Beans (MDB). Distributed programming services CORBA and RMI – Transaction management, Security, deployment building session beans - creating session beans - Entity beans.

**Expected Outcome**
The students will be able to,
1. Acquire the fundamental concepts of web systems and applications.
2. Identify the methodologies and techniques for developing web applications.
3. Get skills to develop websites.

**References**
1. Hans Bergsten, Java Server Pages, O’Reilly, 2003

**COURSE PLAN**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction - Web architecture - web application lifecycle - XML and J2EE. Servlets: Introduction to Servlets, Benefits of Servlets, use as controller in MVC, basic HTTP, servlet container, Servlets API, javax.servlet Package, Reading Servlet parameters, service method detail. HTML clients, servlet lifecycle</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Session management, dispatching requests, Servlets with JDBC, JDBC: Architecture - JDBC API</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>Java Server Pages: Generating Dynamic Content, Using Scripting Elements, Implicit JSP Objects, Conditional Processing – Displaying Values, Setting attributes, Error Handling and Debugging, Using JavaBeans Components in JSP Pages.</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Passing Control and Data between Pages – Sharing Session and Application Data – Application Models - MVC Design</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>V</td>
<td>Enterprise JavaBeans : Overview, distributed programming, EJB framework, Session and entity beans, Stateless and stateful session bean, Bean attributes, Parts of a Bean. Container-Managed Persistence (CMP) and bean managed persistence.</td>
<td>8</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>lifecycle of EJB - Java Message Service (JMS) and Message Driven Beans (MDB). Distributed programming services CORBA and RMI – Transaction management, Security, deployment, building session beans -creating session beans - Entity beans.</td>
<td>8</td>
<td>20%</td>
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END SEMESTER EXAM

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<tr>
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**Note**: Each question can have a maximum of 4 subparts, if needed
Course code | Course Name | L-T-P-Credits | Year of Introduction
IT431 | Web Application Development Lab | 0-0-3-1 | 2016

**Prerequisite:** IT409 Web application development

**Course Objectives**
- To develop the skill in Creating dynamic web pages with servlets
- To provide knowledge in connecting java programs with database using JDBC.
- To develop the skill in server side programming using JSP.
- To provide knowledge about MVC Design.
- Testing the application on an Application Server.
- Debugging Web applications locally and remotely.
- Developing applications in a team environment.

**List of Exercises / Experiments (Minimum 8 are mandatory)**
1. Authentication using Java Servlet
2. Authentication using JSP
3. Authentication using MVC Architecture
4. Design and development of Online Book Shop
5. Design and development of Online Examination
6. Design and development of online ticket reservation system
7. Design and development of online library
8. Design and development of online banking
9. Design and development of online job portal
10. Design and development of Online Auction

**Class Project (Individual) (Mandatory)**
Students are encouraged to propose innovative ideas in the field of E-commerce as projects.

**Expected Outcome**
By the end of the course, the student will be able to:
- i. Write programs in java to access database.
- ii. Write programmes in servlet to create dynamic web pages which access databases and track user sessions
- iii. Develop server side programmes in JSP.
- iv. Design and develop web applications using MVC architecture.
- v. Test and debug a web application.
- vi. Develop web application in a team environment.

**References**
2. Hans Bergsten, Java Server Pages, O'Reilly
Course code | Course Name | L-T-P-Credits | Year of Introduction
--- | --- | --- | ---
IT461 | Software Testing and Quality Assurance | 3-0-0-3 | 2016

Prerequisite: IT364 Software project management

Course Objectives
- To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To learn planning of a test project, designing test cases and data, conducting test operations, managing software problems and defects, and generating a test report.
- To develop an understanding of the meaning and importance of quality in relation to software systems and the software development process.
- To discuss issues and techniques for implementing and managing software quality assurance processes and procedures.

Syllabus

Expected Outcome
The students will be able to
i. Apply software testing knowledge and engineering methods.
ii. Understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods.
iii. Apply the techniques learned to improve the quality of their own software development.
iv. Prepare a software quality plan for a software project.

References
1. Daniel Galin , Software Quality Assurance From theory to implementation, Pearson
2. Louise Tamres , Introducing Software Testing , Pearson

Module | Course Plan | Hours | Sem. Exam Marks
--- | --- | --- | ---
I | Fundamentals of Software Testing – Approaches to testing, Requirement traceability matrix, Essentials of testing, workbench, misconceptions about testing, Principles of Software Testing, test policy, challenges, cost aspect,– Structured approach to Testing – categories of defect, Developing Testing methodologies, skills required for testing. | 3 | 15%

Levels of Testing – proposal testing, requirement testing, design testing, code testing, unit testing, module testing, integration testing, big-bang testing, sandwich testing, critical path first, subsystem testing, system testing, testing stages. | 3
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<tr>
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<tbody>
<tr>
<td><strong>II</strong></td>
<td>Acceptance Testing- importance, alpha testing, beta testing, gamma testing, Customer’s responsibility, Acceptance criteria, criticality of requirements, developing acceptance test plan, user responsibilities, executing acceptance plan. Special Tests I.</td>
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<tr>
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<td><strong>3</strong></td>
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<tr>
<td><strong>FIRST INTERNAL EXAM</strong></td>
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<tr>
<td><strong>III</strong></td>
<td>Special Tests II.</td>
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<tr>
<td></td>
<td><strong>4</strong></td>
</tr>
<tr>
<td></td>
<td>Testing tools- features, guidelines for selecting a tool, tools and skills of testing, static and dynamic testing tools, advantages and disadvantages, automated test tools, process of procurement of COTS, procurement of tools from contractor, contracting a software.</td>
</tr>
<tr>
<td></td>
<td><strong>15%</strong></td>
</tr>
<tr>
<td><strong>IV</strong></td>
<td>Test planning - Test strategy – test plan-Test plan templates (System testing) – Quality plan- quality plan templates. Guidelines for developing test plan - Test Estimation – Test standards – Building Test data and Test cases - Test Scenario – Test Scripts - Tools used to build test data. Testing object oriented software – Testing web applications.</td>
</tr>
<tr>
<td></td>
<td><strong>15%</strong></td>
</tr>
<tr>
<td><strong>SECOND INTERNAL EXAM</strong></td>
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</tr>
<tr>
<td><strong>V</strong></td>
<td>Software quality – definition, Software quality assurance – definition and objectives, Software quality assurance and software engineering. Software quality factors- The need for comprehensive software quality requirements, Classifications of software requirements into software quality factors, Product operation software quality factors, Product revision software quality factors, Product transition software quality factors, Alternative models of software quality factors , Software compliance with quality factors</td>
</tr>
<tr>
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<td><strong>3</strong></td>
</tr>
<tr>
<td></td>
<td>The components of the software quality assurance system – The SQA system – an SQA architecture, Pre-project components, Software project life cycle components, Infrastructure components for error prevention and improvement, Management SQA components, SQA standards, system certification, and assessment components , Organizing for SQA – the human components ,Considerations guiding construction of an organization’s SQA system</td>
</tr>
<tr>
<td><strong>VI</strong></td>
<td>Pre-project software quality components- Contract review- The contract review process and its stages, Contract review objectives, Implementation of a contract review, Contract review subjects. SQA components in the project life cycle- Integrating quality activities in the project life cycle- Classic</td>
</tr>
<tr>
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<td><strong>3</strong></td>
</tr>
</tbody>
</table>
and other software development methodologies. Factors affecting intensity of quality assurance activities in the development process, Verification, validation and qualification, A model for SQA defect removal effectiveness and cost.

Reviews - Review objectives, Formal design reviews (DRs), Peer reviews, comparison of the team review methods, Expert opinions. Assuring the quality of software maintenance components. Introduction - The foundations of high quality, Pre-maintenance software quality components, Maintenance software quality assurance tools

**END SEMESTER EXAM**

**QUESTION PAPER PATTERN**

Maximum Marks: 100  
Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

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<tr>
<th>Course code</th>
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<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT462</td>
<td>Internet of things</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** Nil

**Course Objectives**
- To explore the world of current technologies.
- To understand with the concepts of internet of things.
- To get a knowledge basics in the history and developments of internet.
- To be familiar with the big data and cloud in the IoT basis.

**Syllabus**


**Expected outcome**
- The student will understand the basics of internet, the concepts of internet of things, cloud and big data.

**Text Books:**
4. Dr. Ovidiu Vernesan, Dr Peter Friess, Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, River Publishers, 2013

**References:**
2. Charalampos, Doukas, Building Internet of things with the Arduino, Creat space.

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
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<tbody>
<tr>
<td>I</td>
<td>Internet: An Overview: Introduction, History of Internet, Internet Technology, Basics of Internet, Classification of Internet, Topologies, Applications, Internet of Things and Related Future Internet Technologies, Internet of Things Vision, Towards the IoT Universe(s), The Internet of Things Today.</td>
<td>5</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Internet Communication Technologies, Networks and Communication, Processes, Data Management, IoT Related Standardization, Protocol, Communication protocols, Types of communication protocols, Addressing Schemes, M2M Service Layer Standardisation, OGC Sensor Web for IoT, IEEE and IETF,</td>
<td>8</td>
<td>15%</td>
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<tr>
<td>Modules</td>
<td>Topics</td>
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<tr>
<td>IV</td>
<td>Prototyping in IoT, Basics of prototypes, Prototyping in IoT, Communication in IoT, Prototyping model, Data handling in IoT, fabryq, Bluetooth Low Energy, μfabryq, Operating Systems for Low-End IoT Devices, Open Source Oss, Contiki, RIOT, FreeRTOS, TinyOS, OpenWSN, nuttX, eCos, mbedOS, L4 microkernel family, uClinux, Android and Brillo, Other open source Oss, Closed Source Oss, ThreadX, QNX, VxWorks, Wind River Rocket, PikeOS, emboss, Nucleus RTOS, Sciopta, μC/OS-II and μC/OS-III.</td>
<td></td>
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<tr>
<td>V</td>
<td>Big Data, BigData versus IoT, BigData influence in IoT, A cyclic model of BigData, Cloud and Internet of Things, Data Storage, Analysis and Communication, Classifications, Characteristics of BigData, Types of BigData, Analysing of Data, Applications, Real time situations, BigData tools, A combined application of IoT, Cloud and BigData in IoT.</td>
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</table>

**SECOND INTERNAL EXAMINATION**

<table>
<thead>
<tr>
<th>Modules</th>
<th>Topics</th>
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</thead>
<tbody>
<tr>
<td>V</td>
<td>Prototyping in IoT, Basics of prototypes, Prototyping in IoT, Communication in IoT, Prototyping model, Data handling in IoT, fabryq, Bluetooth Low Energy, μfabryq, Operating Systems for Low-End IoT Devices, Open Source Oss, Contiki, RIOT, FreeRTOS, TinyOS, OpenWSN, nuttX, eCos, mbedOS, L4 microkernel family, uClinux, Android and Brillo, Other open source Oss, Closed Source Oss, ThreadX, QNX, VxWorks, Wind River Rocket, PikeOS, emboss, Nucleus RTOS, Sciopta, μC/OS-II and μC/OS-III.</td>
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<td>VI</td>
<td>Big Data, BigData versus IoT, BigData influence in IoT, A cyclic model of BigData, Cloud and Internet of Things, Data Storage, Analysis and Communication, Classifications, Characteristics of BigData, Types of BigData, Analysing of Data, Applications, Real time situations, BigData tools, A combined application of IoT, Cloud and BigData in IoT.</td>
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</tbody>
</table>

**END SEMESTER EXAM QUESTION PAPER PATTERN**

Maximum Marks: 100
Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note**: Each question can have a maximum of 4 subparts, if needed.
Course code | Course Name | L-T-P-Credits | Year of Introduction  
---|---|---|---
IT463 | Semantic Web | 3-0-0-3 | 2016  
Prerequisite : Nil  
Course Objectives  
- To introduce semantic web technologies and semantic web architecture  
- To study the use of XML in Semantic Web  
- To Explore RDF and OWL  
- To introduce Logic and Inference  
- To study ontology engineering  
- To analyse semantic web applications.  
Syllabus  
Expected Outcome  
- Conceptual understanding of the above topics and ability to apply them in practical situations.  
References  

**COURSE PLAN**  
<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
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<tr>
<td>II</td>
<td>Describing Web Documents in RDF, RDF: XML-Based Syntax, RDF Schema, An Axiomatic Semantics for RDF and RDF Schema, A Direct Inference System for RDF and RDFS, Querying in RQL</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>Web Ontology Language(OWL), Examples, OWL in OWL, Future Extensions</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Logic and Inference:Rules, Example of Monotonic Rules: Family Relationships, Monotonic Rules Syntax and Semantics, Nonmonotonic Rules: Motivation, Syntax and Example, Rule Markup in XML</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>V</td>
<td>Applications: Horizontal Information Products at Elsevier, Data Integration at Audi, Skill Finding at Swiss Life, Think Tank Portal at EnerSearch, e-Learning, Web Services</td>
<td>9</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>Ontology Engineering, Constructing Ontologies Manually, Reusing Existing Ontologies, Using Semiautomatic Methods, On-To-Knowledge Semantic Web Architecture, Key Research challenges in Semantic Web</td>
<td>6</td>
<td>20%</td>
</tr>
</tbody>
</table>

**FIRST INTERNAL EXAM**

**SECOND INTERNAL EXAM**

**END SEMESTER EXAM**

**QUESTION PAPER PATTERN**

Maximum Marks: 100
Exam Duration: 3 hours
The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note:** Each question can have a maximum of 4 subparts, if needed
<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P - Credits</th>
<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT464</td>
<td>Information Storage Management</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Pre-requisites:** NIL

**Course Objectives**
- To understand data creation, the amount of data being created, the value of data to a business, challenges in data storage and data management,
- To understand solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities

**Syllabus**
Storage system architecture, Networked storage, Information availability and monitoring a data centre, remote data replication technologies, securing storage and storage virtualization,

**Expected outcome**.
The student will understand the concept of data storage in distributed environment in data centre, challenges in data storage and management technologies.

**Text Books:**

**References:**

**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Data, Information, Evolution of storage architecture, Data center infrastructure, Information lifecycle. Overview: Virtualization - Cloud, Data center environment: Application - Desktop - Memory virtualization - Connectivity - Disk drive interface -</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Storage media - Flash drives, RAID: Implementation - Methods - Levels, Intelligent storage system</td>
<td>5</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>Introduction to DAS and SCSI, SAN: Evolution - Components - Connectivity options - Ports - FC architecture - Zoning - FC topologies, SAN based virtualization: Block level - VSAN, IP SAN: iSCSI - FCIP components - FCIP topology and frame structure, FCOE: Components – Benefits</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>NAS: Benefits – Components - Implementations - File sharing protocols - I/O operations - Factors affecting NAS performance - File level virtualization, Object based storage: Operation Benefits - Fixed content and archives - Archive types, CAS: Architecture -</td>
<td>7</td>
<td>15%</td>
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<tr>
<td>Module</td>
<td>Topics</td>
<td>Weight</td>
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<td>--------</td>
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<td>--------</td>
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</tr>
<tr>
<td>V</td>
<td>Operations - Use cases, Unified storage</td>
<td>8</td>
<td>20%</td>
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<tr>
<td></td>
<td>SECOND INTERNAL EXAMINATION</td>
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<td>END SEMESTER EXAM</td>
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</tbody>
</table>

**QUESTION PAPER PATTERN**

Maximum Marks: 100

Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

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</thead>
<tbody>
<tr>
<td>IT465</td>
<td>Cyber Forensics</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

Pre-requisites: Nil

Course Objectives
- To understand cyber related crimes and various investigative strategies
- To understand Computer Forensics, Computing Investigations.
- To study forensically sound principles and practices related to digital evidence collection, management, and handling.
- To study the concepts in ethical hacking

Syllabus

Expected outcome:
- The students will get awareness about the cyber related crimes happening in modern world and will help them to identify them.

Text Book:

References:

Course Plan
<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction to Cyber forensics: Information Security Investigations, Corporate Cyber Forensics, Scientific method in forensic analysis, investigating large scale Data breach cases. Analyzing Malicious software.</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Types of Computer Forensics Technology, Types of Military Computer Forensic Technology, Types of Law Enforcement, Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware, Encryption Methods and Vulnerabilities, Protecting Data from Being Compromised Internet Tracing Methods, Security and Wireless Technologies, Avoiding Pitfalls with Firewalls Biometric Security Systems</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>

FIRST INTERNAL EXAMINATION

**SECOND INTERNAL EXAMINATION**

**END SEMESTER EXAM**

**QUESTION PAPER PATTERN**

Maximum Marks: 100  
Exam Duration: 3 hours  
The question paper shall consist of Part A, Part B and Part C.  

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).  

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).  

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).  

**Note**: Each question can have a maximum of 4 subparts, if needed.
<table>
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<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT466</td>
<td>Adhoc and Sensor Networks</td>
<td>3-0-0-3</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** Nil

**Course Objectives**

- To understand and apply the fundamental concepts of Internet of Things definitions, frameworks, applications, mechanisms and key technologies
- To evolve IoT standards
- To know wireless technologies and IPv6 technologies for the IoT

**Syllabus**


**Expected outcome**

- Conceptual understanding of the above topics and ability to apply them in practical situations.

**References:**


**Course Plan**

<table>
<thead>
<tr>
<th>Module</th>
<th>Contents</th>
<th>Hours</th>
<th>Sem. Exam Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>WHAT IS THE INTERNET OF THINGS? - Overview and Motivations, Examples of Applications, IPv6 Role, Areas of Development and Standardization, IoT Definitions, IoT Frameworks, IoT application Example.</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>EVOLVING IoT STANDARDS - Overview and Approaches, IETF IPv6 Routing Protocol for RPL Roll, Constrained Application Protocol (CoAP) - Background, Messaging Model,</td>
<td>7</td>
<td>15%</td>
</tr>
</tbody>
</table>

**FIRST INTERNAL EXAMINATION**
### RequestResponse Model, Intermediaries and Caching, Representational State Transfer (REST), ETSI M2M, Third-Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Lowpower WPAN (6LoWPAN), ZigBee IP (ZIP), IP in Smart Objects (IPSO)

| Layer 1/2 Connectivity: Wireless Technologies for the IoT - WPAN Technologies for IoT M2M - ZigbeeIEEE 802.15.4, Radio Frequency for Consumer Electronics (RF4CE), IEEE 802.15.6 WBANs, Cellular and Mobile Network Technologies for IoT M2M - Overview and Motivations, Universal Mobile Telecommunications System, LTE |
|---|---|
| IV | 7 | 15% |

### Second Internal Examination

<table>
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<tbody>
<tr>
<td>V</td>
<td>7</td>
</tr>
</tbody>
</table>


| VI | 7 | 20% |

### End Semester Exam

**Question Paper Pattern**

Maximum Marks: 100  
Exam Duration: 3 hours

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).

**Note**: Each question can have a maximum of 4 subparts, if needed
<table>
<thead>
<tr>
<th>Course code</th>
<th>Name</th>
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<th>Year of Introduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT332</td>
<td>Internet Technology Lab</td>
<td>0-0-3-1</td>
<td>2016</td>
</tr>
</tbody>
</table>

**Prerequisite:** IT302 Internet technology

**Course objectives**
- To create web pages using HTML, Cascading Styles sheets, XML, Javascript and PHP

**LIST OF EXERCISES / EXPERIMENTS**

1. Install, setup and configure Web server bundles (wamp/xamp/Apache/IIS etc.)
2. Create a web page with all possible elements of HTML5
3. Create a web page with all types of Cascading style sheets
4. Programs to demonstrate JavaScript array, object and functions
5. Client Side Scripts for Validating Web Form Controls using JavaScript
6. Programs to demonstrate DOM event bubbling.
7. Programs using XML – DTD Schema – XSLT/XSL
8. Programs using XML – Schema XSLT/XSL
9. Programs using XML – XSLT/XSL
10. Programs using AJAX
11. Server Side Scripting using PHP
12. Programs using session tracking in PHP
13. Programs using cookies tracking in PHP
14. Programs using MySQL database connectivity in PHP

**Expected Outcomes**
The students will be able to
- i. analyze and create web pages using HTML, Cascading Styles sheets, XML, Javascript, PHP and the workings of the web and web applications
- ii. develop and deploy web applications in real world application scenarios.

**REFERENCES**
2. www.w3schools.com