# NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi) Erode-638 052, Tamil Nadu, India, Phone: 04294 – 225585



## Curriculum and Syllabi for M.E – Computer Science and Engineering [R17] [CHOICE BASED CREDIT SYSTEM]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year 2017-2018 onwards)

# **OCTOBER 2020**

N. Japan

#### COMPUTER SCIENCE AND ENGINEERING DEPARTMENT PEOS, PSOs and POs

#### PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

The following Programme Educational Objectives are designed for B.E. Computer Science and Engineering programme in Computer Science and Engineering based on the Department Vision & Mission to provide higher engineering education and motivate research in the field of Computer Engineering.

- PEO 1. Graduates will be employed in IT industries to solve industrial technological issues.
- **PEO 2.** Graduates will take up masters and pursue career paths in teaching and research.
- **PEO 3.** Graduates will be an entrepreneur who develops, deploys and maintains Real-time software.
- PEO 4. Graduates will continuously learn and adopt new technologies to solve communal issues.
- **PEO 5.** Graduates will enhance leadership skills and contribute towards societal growth.

#### PROGRAM SPECIFIC OUTCOMES (PSOs):

- **PSO1.** Ability to understand the principles and working of hardware and software aspects in a computer system
- **PSO2.** Ability to demonstrate knowledge in mathematical models, algorithms and software development methodologies
- PSO3. Ability to develop practical competency in programming languages and open source platforms
- PSO4. Ability to provide a foundation for higher studies, research and entrepreneurship

# PROGRAMME OUTCOMES (POs)

| 1-12 | GRADUATE ATTRIBUTES                    | PO<br>No. | PROGRAMME OUTCOMES   |
|------|--|-----------|--|
| 1    | Engineering Knowledge                  | PO1       | Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.  |
| 2    | Problem Analysis                       | PO2       | Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.  |
| 3    | Design and Development of<br>Solutions | PO3       | Design solutions for complex engineering problems and design<br>system components or processes that meet the specified needs<br>with appropriate consideration for the public health and safety,<br>and the cultural, societal, and environmental considerations.                              |
| 4    | Investigation of Complex Problems      | PO4       | Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.   |
| 5    | Modern Tool Usage                      | PO5       | Create, select, and apply appropriate techniques, resources, and<br>modern engineering and IT tools including prediction and<br>modeling to complex engineering activities with an<br>understanding of the limitations.  |
| 6    | The Engineer and Society               | PO6       | Apply reasoning informed by the contextual knowledge to<br>assess societal, health, safety, legal and cultural issues and the<br>consequent responsibilities relevant to the professional<br>engineering practice.   |
| 7    | Environment and Sustainability         | PO7       | Understand the impact of the professional engineering solutions<br>in societal and environmental contexts, and demonstrate the<br>knowledge of, and need for sustainable development.  |
| 8    | Ethics                                 | PO8       | Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.   |
| 9    | Individual and Team Work.              | PO9       | Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.  |
| 10   | Communication                          | PO10      | Communicate effectively on complex engineering activities with<br>the engineering community and with society at large, such as,<br>being able to comprehend and write effective reports and design<br>documentation, make effective presentations, and give and<br>receive clear instructions. |
| 11   | Project Management and Finance         | P011      | Demonstrate knowledge and understanding of the engineering<br>and management principles and apply these to one's own work,<br>as a member and leader in a team, to manage projects and in<br>multidisciplinary environments.   |
| 12   | Lifelong Learning                      | PO12      | Recognize the need for, and have the preparation and ability to<br>engage in independent and life-long learning in the broadest<br>context of technological change.  |

#### MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Programme educational objectives and the Program Outcomes is given in the following table

| PROGRAMME                 |   |   |   |   | PROG | RAMM | E OUTC | OMES |   |   |   |   |
|---------------------------|---|---|---|---|------|------|--------|------|---|---|---|---|
| EDUCATIONAL<br>OBJECTIVES | а | b | с | d | е    | f    | g      | h    | i | j | k | I |
| 1                         | 3 | 3 | 3 | 3 | 3    | 2    | 2      | 2    | 3 | 3 | 3 | 3 |
| 2                         | 3 | 3 | 3 | 3 | 3    | 2    | 2      | 1    | 3 | 3 | 2 | 3 |
| 3                         | 3 | 3 | 3 | 3 | 3    | 2    | 2      | 2    | 3 | 3 | 3 | 3 |
| 4                         | 3 | 3 | 3 | 3 | 3    | 2    | 2      | 1    | 3 | 3 | 2 | 3 |
| 5                         | 3 | 3 | 3 | 3 | 3    | 3    | 2      | 2    | 2 | 3 | 3 | 3 |

#### MAPPING OF PROGRAM SPECIFIC OUTCOMES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Outcomes and the Programme Outcomes is given in the following table

| PROGRAM              |   |   |   |   | PROG | RAMM | E OUTC | OMES |   |   |   |   |
|----------------------|---|---|---|---|------|------|--------|------|---|---|---|---|
| SPECIFIC<br>OUTCOMES | а | b | с | d | е    | f    | g      | h    | i | j | k | I |
| 1                    | 3 | 3 | 2 | 2 | 2    | 1    | 1      | 1    | 1 | 1 | 1 | 2 |
| 2                    | 3 | 3 | 3 | 3 | 2    | 2    | 1      | 3    | 1 | 2 | 3 | 3 |
| 3                    | 3 | 3 | 3 | 3 | 3    | 3    | 1      | 2    | 1 | 1 | 2 | 3 |
| 4                    | 3 | 3 | 2 | 3 | 3    | 2    | 2      | 3    | 1 | 2 | 2 | 3 |

\* Contribution

1: Reasonable

2: Significant

3: Strong

#### NANDHA ENGINEERING COLLEGE

### **REGULATIONS 2017**

### M.E. Computer Science and Engineering

## CHOICE BASED CREDIT SYSTEM

# I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

#### SEMESTER I

| SI.<br>NO. | COURSE<br>CODE | COURSE TITLE                                      | CATEGORY | PREREQUISITE | CONTACT<br>PERIODS | L  | Т | Ρ | С  |
|------------|----------------|---|----------|--------------|--------------------|----|---|---|----|
| THEC       | DRY            |   |          |              |                    |    |   |   |    |
| 1          | 17CPA01        | Theoretical<br>Foundations of<br>Computer Science | FC       | NIL          | 4                  | 3  | 1 | 0 | 4  |
| 2          | 17CPA02        | Design and<br>Management of<br>Computer Networks  | FC       | NIL          | 3                  | 3  | 0 | 0 | 3  |
| 3          | 17CPB01        | Object Oriented<br>Software Engineering           | PC       | NIL          | 3                  | 3  | 0 | 0 | 3  |
| 4          | 17CPB02        | Advanced Data<br>Structures and<br>Algorithms     | PC       | NIL          | 4                  | 3  | 2 | 0 | 4  |
| 5          | 17CPB03        | Multicore Architecture and Programming            | PC       | NIL          | 3                  | 3  | 0 | 0 | 3  |
| 6          | E1             | Elective (PE)                                     | PE       | Ref. PE      | 3                  | 3  | 0 | 0 | 3  |
| PRAC       | CTICALS        |   | •        |              |                    |    |   |   |    |
| 7          | 17CPP01        | Data Structures<br>Laboratory                     | PC       | NIL          | 4                  | 0  | 0 | 4 | 2  |
|            |                |   |          | TOTAL        | 24                 | 18 | 2 | 4 | 22 |

|            | SEMESTER II   |                                      |          |              |                    |    |   |   |    |  |  |  |
|------------|---|--------------------------------------|----------|--------------|--------------------|----|---|---|----|--|--|--|
| SI.<br>NO. | COURSE<br>CODE                                      | COURSE TITLE                         | CATEGORY | PREREQUISITE | CONTACT<br>PERIODS | L  | Т | Ρ | С  |  |  |  |
| THE        | ORY   |                                      |          |              |                    |    |   |   |    |  |  |  |
| 1          | 17CPB04   | Web Services                         | PC       | NIL          | 4                  | 3  | 1 | 0 | 4  |  |  |  |
| 2          | 17CPB05   | Advanced Database<br>Technology      | PC       | NIL          | 3                  | 3  | 0 | 0 | 3  |  |  |  |
| 3          | 17CPB06   | Security Principles and<br>Practices | PC       | NIL          | 3                  | 3  | 0 | 0 | 3  |  |  |  |
| 4          | 17CPB07   | Advanced Operating<br>Systems        | PC       | NIL          | 4                  | 3  | 2 | 0 | 4  |  |  |  |
| 5          | E2  | Elective (PE)                        | PE       | Ref. PE      | 3                  | 3  | 0 | 0 | 3  |  |  |  |
| 6          | E3  | Elective (PE/OE)                     | PE/OE    | Ref. PE      | 3                  | 3  | 0 | 0 | 3  |  |  |  |
| PRA        | CTICALS   |                                      |          |              |                    |    |   |   |    |  |  |  |
| 7          | 717CPP02Database Technology<br>LaboratoryPCNIL40042 |                                      |          |              |                    |    |   |   |    |  |  |  |
| 8          | 17CPE01   | Technical Term Paper                 | EEC      | NIL          | 2                  | 0  | 0 | 2 | 1  |  |  |  |
|            |   |                                      |          | TOTAL        | 26                 | 18 | 2 | 6 | 23 |  |  |  |

#### SEMESTER III

| SI.<br>NO | COURSE<br>CODE | COURSE TITLE    | CATEGO<br>RY | PREREQUISITE | CONTACT<br>PERIODS | L | Т | Р  | С  |
|-----------|----------------|-----------------|--------------|--------------|--------------------|---|---|----|----|
| THE       | ORY            |                 |              |              |                    |   |   |    |    |
| 1         | E4             | Elective (PE)   | PE           | Ref. PE      | 3                  | 3 | 0 | 0  | 3  |
| 2         | E5             | Elective (PE)   | PE           | Ref. PE      | 3                  | 3 | 0 | 0  | 3  |
| 3         | E6             | Elective (PE)   | PE           | Ref. PE      | 3                  | 3 | 0 | 0  | 3  |
| PRA       | CTICALS        |                 |              |              | ·                  |   |   |    |    |
| 4.        | 17CPE02        | Project Phase I | EEC          | NIL          | 12                 | 0 | 0 | 12 | 6  |
|           |                |                 |              | TOTAL        | 21                 | 9 | 0 | 12 | 15 |

#### SEMESTER IV

| SI.<br>NO | COURSE<br>CODE | COURSE TITLE     | CATEGORY | PREREQUISITE | CONTACT<br>PERIODS | L | Т | Р  | С  |
|-----------|----------------|------------------|----------|--------------|--------------------|---|---|----|----|
| 1.        | 17CPE03        | Project Phase II | EEC      | 17CPE02      | 24                 | 0 | 0 | 24 | 12 |
|           |                |                  |          | TOTAL        | 24                 | 0 | 0 | 24 | 12 |

# FOUNDATION COURSES (FC)

| SI.<br>NO | COURSE<br>CODE | COURSE TITLE                                   | CATEGORY | PREREQUISITE | CONTACT<br>PERIODS | L | Т | Ρ | С |
|-----------|----------------|--|----------|--------------|--------------------|---|---|---|---|
| 1         | 17CPA01        | Theoretical Foundations of<br>Computer Science | FC       | NIL          | 4                  | 3 | 1 | 0 | 4 |
| 2         | 17CPA02        | Design and Management of<br>Computer Networks  | FC       | NIL          | 3                  | 3 | 0 | 0 | 3 |

# PROFESSIONAL CORE (PC)

| SI.<br>NO | COURSE<br>CODE | COURSE TITLE                               | CATEGORY | PREREQUISITE | CONTACT<br>PERIODS | L | Т | Ρ | C |
|-----------|----------------|--|----------|--------------|--------------------|---|---|---|---|
| 1.        | 17CPB01        | Object Oriented Software<br>Engineering    | PC       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 2.        | 17CPB02        | Advanced Data Structures<br>and Algorithms | PC       | NIL          | 4                  | 3 | 2 | 0 | 4 |
| 3.        | 17CPB03        | Multicore Architecture and<br>Programming  | PC       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 4.        | 17CPP01        | Data Structures Laboratory                 | PC       | NIL          | 4                  | 0 | 0 | 4 | 2 |
| 5.        | 17CPB04        | Web Services                               | PC       | NIL          | 4                  | 3 | 1 | 0 | 4 |
| 6.        | 17CPB05        | Advanced Database<br>Technology            | PC       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 7.        | 17CPB06        | Security Principles and<br>Practices       | PC       | NIL          | 3                  | 3 | 0 | 0 | 3 |

| 8. | 17CPB07 | Advanced Operating Systems        | PC | NIL | 4 | 3 | 2 | 0 | 4 |
|----|---------|-----------------------------------|----|-----|---|---|---|---|---|
| 9. | 17CPP02 | Database Technology<br>Laboratory | PC | NIL | 4 | 0 | 0 | 4 | 2 |

# **PROFESSIONAL ELECTIVES (PE)**

| SI.<br>NO | COURSE<br>CODE | COURSE TITLE                                 | CATEGORY | PREREQUISITE | CONTACT<br>PERIODS | L | Т | Р | C |
|-----------|----------------|--|----------|--------------|--------------------|---|---|---|---|
| 1.        | 17CPX01        | TCP/IP Technology                            | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 2.        | 17CPX02        | Data Warehousing and Data Mining             | PE       | 17CPB05      | 3                  | 3 | 0 | 0 | 3 |
| 3.        | 17CPX03        | Distributed Systems                          | PE       | 17CPB07      | 3                  | 3 | 0 | 0 | 3 |
| 4.        | 17CPX04        | Mobile Computing                             | PE       | 17CPA02      | 3                  | 3 | 0 | 0 | 3 |
| 5.        | 17CPX05        | Software Project<br>Management               | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 6.        | 17CPX06        | High Speed Networks                          | PE       | 17CPA02      | 3                  | 3 | 0 | 0 | 3 |
| 7.        | 17CPX07        | Data Science and Big Data<br>Analytics       | PE       | 17CPB05      | 3                  | 3 | 0 | 0 | 3 |
| 8.        | 17CPX08        | Parallel Algorithms                          | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 9.        | 17CPX09        | Compiler Construction and<br>Optimization    | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 10.       | 17CPX10        | Adhoc Networks                               | PE       | 17CPA02      | 3                  | 3 | 0 | 0 | 3 |
| 11.       | 17CPX11        | Machine Learning<br>Techniques               | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 12.       | 17CPX12        | Digital Image Processing and<br>Applications | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 13.       | 17CPX13        | Software Requirement<br>Engineering          | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 14.       | 17CPX14        | Wireless Sensor Networks                     | PE       | 17CPA02      | 3                  | 3 | 0 | 0 | 3 |
| 15.       | 17CPX15        | Virtualization Techniques                    | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 16.       | 17CPX16        | Soft Computing                               | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 17.       | 17CPX17        | Mobile Application<br>Development            | PE       | 17CPA02      | 3                  | 3 | 0 | 0 | 3 |
| 18.       | 17CPX18        | Network Optimization<br>Techniques           | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 19.       | 17CPX19        | Pattern Recognition                          | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 20.       | 17CPX20        | Evolutionary Computing                       | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 21.       | 17CPX21        | Semantic Web                                 | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 22.       | 17CPX22        | Internet of Things                           | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 23.       | 17CPX23        | Cloud Computing<br>Technologies              | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 24.       | 17CPX24        | Next Generation Networks                     | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |
| 25.       | 17CPX25        | Web Engineering                              | PE       | NIL          | 3                  | 3 | 0 | 0 | 3 |

### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

| SI.<br>NO | COURSE<br>CODE | COURSE TITLE         | CATEGORY | PREREQUISITE | CONTACT<br>PERIODS | L | Т | Ρ  | С  |
|-----------|----------------|----------------------|----------|--------------|--------------------|---|---|----|----|
| 1.        | 17CPE01        | Technical Term Paper | EEC      | NIL          | 2                  | 0 | 0 | 2  | 1  |
| 2.        | 17CPE02        | Project Phase I      | EEC      | NIL          | 12                 | 0 | 0 | 12 | 6  |
| 3.        | 17CPE03        | Project Phase II     | EEC      | 17CPE02      | 24                 | 0 | 0 | 24 | 12 |

### **OPEN ELECTIVE COURSES (OE)**

| SI.<br>NO. | COURSE<br>CODE | COURSE TITLE         | CATEGORY | PREREQUISITE | CONTACT<br>PERIODS | L | Т | Ρ | С | P.S |
|------------|----------------|----------------------|----------|--------------|--------------------|---|---|---|---|-----|
| 1.         | 17BAZ01        | Research Methodology | OE       | -            | 3                  | 3 | 0 | 0 | 3 | =   |

#### SUMMARY

| SI No   |              |    | CREDITS |     |    |    |
|---------|--------------|----|---------|-----|----|----|
| 51. NO. | SUBJECT AREA | I  | II      | III | IV |    |
| 1       | FC           | 7  | -       | -   | -  | 7  |
| 2       | PC           | 12 | 16      | -   | -  | 28 |
| 3       | PE           | 3  | 6       | 9   | -  | 18 |
| 4       | EEC          | -  | 1       | 6   | 12 | 19 |
| CR      | EDITS TOTAL  | 22 | 23      | 15  | 12 | 72 |

### TOTAL CREDITS (22+23+15+12) =72 CREDITS



|        |  |     |  | L   | Т                              | Р                          | С              |
|--------|--|-----|--|---|--------------------------------|----------------------------|----------------|
|        |  |     |  | 3   | 1                              | 0                          | 4              |
| PREREC | QUISITE: NIL   |     |  |   |                                |                            |                |
| COURSE | E OBJECTIVES AND OUTCOMES:   | 1   |  |   |                                |                            |                |
|        | Course Objectives  |     | Course Outcomes  |   |                                | Relate<br>Progra<br>outcon | ed<br>m<br>nes |
| 1.0    | To understand and use the terms<br>cardinality, finite and countable<br>infinite sets and determine which<br>of these characteristics is<br>associated with a given set. | 1.1 | The Students will be able to o validity of the arguments.  | heck th   | 1e<br>1                        | ,2,5,6,7                   | ′,8,9          |
| 2.0    | To provide students with the<br>understanding of various types of<br>graphs including Regular graphs<br>and Random graphs.   | 2.1 | The Students will be able<br>whether a particular combination<br>is a valid sentence or not.   | to cheo<br>i of word                                      | ck<br>ds 1                     | ,2,5,6,7<br>10, 11,        | ',8,9,<br>,12  |
| 3.0    | To impart the knowledge of modelling and languages.  | 3.1 | The Students will be able<br>propositional logic, including<br>English description with proposi<br>connectives and doing with truth<br>and will be conversant in predica | to solv<br>modellir<br>itions ar<br>h analys<br>te logic. | ve<br>ng<br>nd <b>1</b><br>sis | ,2,7,8,1                   | 0,11           |
| 4.0    | To understand more complex queuing systems.  | 4.1 | The Students will be able to ex<br>basic characteristic features of a<br>system and acquire skills in<br>queuing models.   | xpose th<br>a queuir<br>analyzir                          | ne<br>ng<br>ng                 | 1,2,11,                    | ,12            |
| 5.0    | To get ready for more advanced<br>courses in automation theory,<br>formal languages, algorithms &<br>logic   | 5.1 | The Students will be able problems using formal langua automata.   | to solv<br>ages ar  | ve<br>nd                       | 1,2,11,                    | ,12            |

**17CPA01 THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE** 

#### UNIT I FOUNDATIONS

Sets-Relations-Equivalence relations-Partial orders-Functions-Recursive functions-Sequences-Induction principle-Structural induction-Recursive algorithms-Counting - Pigeonhole principle-Permutations and Combinations (Self study)-Recurrence relations.

#### UNIT II LOGIC

Propositional logic-Logical connectives-Truth tables-Normal forms (conjunctive and disjunctive)-Predicate logic-Universal and existential quantifiers-Proof techniques-Direct and Indirect-Proof by contradiction-Mathematical Induction (Self study).

### UNIT III GRAPH STRUCTURES

Tree Structures- Graph Structures- Graph Representations-Regular graph structures-Random graphs-Connectivity-Cycles-Graph coloring-Cliques, Vertex Covers, Independent sets-Spanning Trees-Network flows(Self study)-Matching.

### UNIT IV QUEUE MODELS

Characteristics of Queuing Models- Kendal's Notation-Single and Multi-Server Markovian queuing models – M/M/1, M/M/C(Self study) (finite and infinite capacity) and (M/G/1):( $\infty/GD$ ).

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### (9+3)

# (9+3)

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#### **9** | P a g e

#### UNIT V MODELING COMPUTATION AND LANGUAGES

Finite state machines – Deterministic and Non- deterministic finite state machines – Turing Machines – Formal Languages – Classes of Grammars – Type 0 – Context Sensitive – Context Free – Regular Grammars(Self study) – Ambiguity.

#### TOTAL = 60 PERIODS

#### **REFERENCES:**

- 1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 5th ed., TMH, 2003 .
- 2. M.K. Venkataraman, N. Sridharan and N.Chandrasekaran," Discrete Maths.", The National Publishing Company, 2003.
- 3. Kishore S Trivedi, "Probability and statistics with reliability, Queuing and computer science applications", PHI, 2006.
- 4. H. A. Taha, ," Operations Research" An Introduction,8th Edition, Prentice Hall of India Ltd, New Delhi, 2008
- 5. Ralph P Girmaldi and B.V. Ramana, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education Asia, Delhi, 2007.



#### 17CPA02 DESIGN AND MANAGEMENT OF COMPUTER NETWORKS

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3

### PREREQUISITE: NIL

#### COURSE OBJECTIVES AND OUTCOMES:

|     | Course Objectives  |     | Course Outcomes   | Related<br>Program<br>outcomes |
|-----|--|-----|---|--------------------------------|
| 1.0 | To understand the network design and management tools                      | 1.1 | The student will be able to understand<br>the network analysis and its<br>management application.                         | 1                              |
| 2.0 | To gain knowledge about network services and its requirement.              | 2.1 | The student will be able to able to know<br>the design requirements, capacity for<br>development and system requirements. | 8, 10,12                       |
| 3.0 | To familiarize the network flow and analyze its flow                       | 3.1 | The student will be able to understand<br>the network flow and flow related<br>algorithms.                                | 3                              |
| 4.0 | To provide an idea about network architecture                              | 4.1 | The student will be able to use the network architecture components and different architecture models.                    | 1, 2                           |
| 5.0 | To understand the network management technology for the real world entity. | 5.1 | The student will be able to apply the protocols and techniques for designing the network.                                 | 2, 11,12                       |

#### UNIT I INTRODUCTION TO NETWORK MANAGEMENT

Overview of Analysis, Architecture and Design Process-System Methodology, Service methodology, Service Description - Service characteristics - Performance Characteristics - Network supportability - Requirement analysis – User Requirements – Application Requirements – Device Requirements – Network Requirements – Other Requirements - Requirement specification and map.

#### UNIT II REQUIREMENTS ANALYSIS

Requirement Analysis Process – Gathering and Listing Requirements- Developing service metrics – Characterizing behavior – Developing RMA requirements – Developing delay Requirements -Developing capacity Requirements - Developing supplemental performance Requirements –Requirements mapping– Developing the requirements specification.

#### UNIT III FLOW ANALYSIS

Individual and Composite Flows – Critical Flows - Identifying and developing flows – Data sources and sinks – Flow models- Flow prioritization – Flow specification algorithms – Example Applications of Flow Analysis.

#### UNIT IV NETWORK ARCHITECTURE

Architecture and design – Component Architectures – Reference Architecture – Architecture Models – System and Network Architecture – Addressing and Routing Architecture – Addressing and Routing Fundamentals – Addressing Mechanisms – Addressing Strategies – Routing Strategies – Network Management Architecture – Network Management Mechanisms Performance Architecture – Performance Mechanisms – Security and Privacy Architecture – Planning security and privacy Mechanisms.

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# (9)

#### UNIT V NETWORK DESIGN

Design Concepts – Design Process - Network Layout – Design Traceability – Design Metrics –Logical Network Design – Topology Design – Bridging, Switching and Routing Protocols- Physical Network Design – Selecting Technologies and Devices for Campus and Enterprise Networks – Optimizing Network Design.

#### TOTAL :( L: 45 ) = 45 PERIODS

#### **REFERENCES:**

- 1. Network Analysis, Architecture, and Design by James D. McCabe, Morgan Kaufmann, 3<sup>rd</sup> ed., 2007.ISBN-13: 978-0123704801.
- 2. Computer Networks: A Systems Approach by Larry L. Peterson, Bruce S. Davie 2007, Elsevier Inc.
- Top-down Network Design: [a Systems Analysis Approach to Enterprise Network Design] By Priscilla Oppenheimer, Cisco Press, 3<sup>rd</sup> ed., ISBN-13: 978-1-58720-283-4 ISBN-10: 1-58720-283-2.



|             | 17CPB01 OBJECT ORIENTED SOFTWARE ENGINEERING |             |  |         |      |           |                |
|-------------|--|-------------|--|---------|------|-----------|----------------|
|             |  |             |  | L       | Т    | Р         | С              |
|             |  |             |  | 3       | 0    | 0         | 3              |
|             |  |             |  |         |      |           |                |
| COURSI      | OBJECTIVES AND OUTCOMES.                     |             |  |         |      | Delete    | 4              |
|             | Course Objectives                            |             | Course Outcomes                          |         |      | Program   | u<br>n         |
|             |  |             |  |         |      | Outcom    | ies            |
|             | To study the concepts of modelling in        |             | The student will be able to              | constru | uct  |           |                |
| 1.0         | object oriented contexts.                    | 1.1         | static and dynamic m software using UML. | odels   | of 1 | 2,3,5,7,9 | 9, 10          |
|             | To study and learn how to apply analysis     |             | The student will be                      | able    | to   |           |                |
| 2.0         | techniques and methodologies including       | 21          | understand various techr                 | niques  | for  | 1,2,3,4,7 | ', <b>8</b> ,  |
| 2.0         | Use cases, System Sequence                   | 2.1         | gathering and analyzin                   | g use   | rs   | 10, 11,   | 12             |
|             | Diagrams.                                    |             |  |         |      |           |                |
|             | To study and learn how to apply design       |             | The student will be able                 | to desi | gn   | 1278-     | 10             |
| 3.0         | techniques and methodologies including       | 3.1         | plan software solut                      | ions    | to   | 11.12     | 10,            |
|             | Interaction Diagrams, Class Diagrams.        |             | problems.                                |         |      | ,         |                |
|             | To Analyze Object-Oriented (OO)              |             | The student will be                      | able    | to   |           |                |
| 4.0         | approach to software development             |             | understand UU conce                      | epts a  | na   | 4057      | •              |
| 4.0         | through OO principles and design             | 4.1         |  | 533.    |      | 1,3,5,7   | ,9             |
|             | Language).                                   |             |  |         |      |           |                |
|             | To study and learn how to apply              |             | The student will be able                 | to apr  | olv  |           |                |
| 5.0         | advanced techniques including                | E 4         | advanced techniques for                  | desi    | gn   | 4957      | •              |
| <b>J.</b> 0 | Architectural Analysis and Design            | <b>J</b> .1 | and analysis of the                      | softwa  | are  | 1,3,3,7   | , <del>э</del> |
|             | Patterns.                                    |             | system.                                  |         |      |           |                |

#### UNIT I INTRODUCTION

Introduction– Software Engineering Concepts– Development Activities– Managing Software Development– Unified Modelling Language– Project Organization and Communication.

#### UNIT II ANALYSIS

Requirements Elicitation–Concepts– Activities–Management– Analysis concepts– Analysis Activities.

#### UNIT III SYSTEM DESIGN

Decomposing the system – Overview of System Design– System Design Concepts– System Design Activities – Addressing Design Goals – Managing System Design.

### UNIT IV OBJECT DESIGN AND IMPLEMENTATION ISSUES

Reusing Pattern Solutions–Specifying Interfaces– Mapping Models to Code–Testing

### UNIT V MANAGING CHANGE

Rationale Management– Configuration Management–Project Management– Software Life Cycle.

### TOTAL :( L: 45 ) = 45 PERIODS

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### **REFERENCES:**

- 1. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 3<sup>rd</sup> ed., Pearson Education, 2010.
- 2. Timothy C. Lethbridge, Robert Laganiere, Object Oriented Software Engineering, Tata McGraw-Hill, 2004
- 3. Craig Larman, Applying UML and Patterns, 3<sup>rd</sup> ed., Pearson Education, 2005.
- 4. Stephen Schach, Software Engineering 7<sup>th</sup> ed., McGraw-Hill, 2007.



#### 17CPB02 ADVANCED DATA STRUCTURES AND ALGORITHMS

#### PREREQUISITE: NIL

## COURSE OBJECTIVES AND OUTCOMES:

| Course Objectives |  |     | Course Outcomes   | Related<br>Program<br>outcomes |
|-------------------|--|-----|---|--------------------------------|
| 1.0               | To learn the basic techniques of algorithm analysis.       | 1.1 | The student will be able to use recursive design.   | 1,3,5,7,8,9,<br>10,11          |
| 2.0               | To understand the concepts of notations and analysis.      | 2.1 | The student will be able to implement<br>the main data structures and use<br>them to solve computational<br>problems. | 1,2,3,7,9,10,<br>11,12         |
| 3.0               | To familiar with writing recursive methods.                | 3.1 | The student will be able to master different algorithm design techniques.   | 1,2,3,7,9,10,<br>11,12         |
| 4.0               | To understand the concepts of Heaps and Search structures. | 4.1 | The student will be able to apply and<br>implement learned algorithm design<br>techniques to solve problems           | 1,3,4,5,7,9,10,<br>11,12       |
| 5.0               | To familiar with advanced algorithms.                      | 5.1 | The student will be able to design complex and advanced data structures   | 1,3,5,7,9,11                   |

## UNIT I FUNDAMENTALS

Introduction to Linear and Non Linear data structures - Mathematical Induction - Asymptotic Notations – Properties of Big-oh Notation – Conditional Asymptotic Notation –Algorithm Analysis – Amortized Analysis – NP Completeness – NP-Hard – Recurrence Equations – Solving Recurrence Equations – Memory Representation of Multi-dimensional Arrays – Time-Space Tradeoff.

## **UNIT II HEAP STRUCTURES**

Min/Max heaps – Deaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps – Lazy-Binomial Heaps.

## UNIT III SEARCH STRUCTURES

Binary Search Trees - AVL Trees - Red-Black trees - Multi-way Search Trees - B+ Trees - Splay Trees - Tries.

# UNIT IV ANALYSIS AND DESIGN OF ALGORITHMS

Sorting - Searching - Design Techniques - Greedy Methods – Dynamic Programming - Divide and Conquer - Back Tracking – Applications.

# UNIT V ADVANCED ALGORITHMS

15 | Page

Huffman Coding – Convex Hull – Topological Sort – Tree Vertex Splitting – Activity Networks – Flow Shop Scheduling – Counting Binary Trees – Introduction to Randomized Algorithms.

TOTAL :( L: 45,T:30 ) = 75 PERIODS

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- 1. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, 2007.
- 2. E. Horowitz, S. Sahni and S. Rajasekaran, "Computer Algorithms/C++", 2<sup>nd</sup> ed., University Press, 2007.
- 3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education, 2002.
- 4. Alfred .V. Aho, John .E. Hopcroft, and Jeffrey .D. Ullman, "Data Structures and Algorithms", Addison-Wesley Publications, 2010.



#### 17CPB03 MULTICORE ARCHITECTURE AND PROGRAMMING

#### PREREQUISITE: NIL

#### COURSE OBJECTIVES AND OUTCOMES:

|     | Course Objectives   |     | Course Outcomes   | Related<br>Program<br>outcomes |
|-----|---|-----|---|--------------------------------|
| 1.0 | To understand the basic structure and operation of multicore process.                               | 1.1 | The student will be able to understand about multi-core architectures.  | 1,11,12                        |
| 2.0 | To study the design of arithmetic<br>and logic unit and implementation of<br>arithmetic operations. | 2.1 | The student will be able to write parallel programs.  | 1,3                            |
| 3.0 | To study the two types of control unit techniques and parallel programming.                         | 3.1 | The student will be able to know the issues of operating system, compiler for multi-core system.                | 1,4,6,9,10,11,12               |
| 4.0 | To study the hierarchical memory system including cache memories and.                               | 4.1 | The student will be able to understand<br>the issues related to processors,<br>memories, I/O devices.           | 1,4,7,10,11,12                 |
| 5.0 | To provide knowledge of memory technologies, interfacing techniques and subsystem devices.          | 5.1 | The student will be able to use memory technologies, interfacing techniques and subsystem devices. efficiently. | 1,4,7,10,11,12                 |

### UNIT I INTRODUCTION

Instruction Level Parallelism, Thread level parallelism–parallel computer models–Symmetric and distributed shared memory architectures – Performance Issues – Multi-core Architectures - Software and hardware multithreading – SMT and CMP architectures –Design issues – Case studies – Intel Multi-core architecture – SUN CMP architecture.

#### UNIT II PARALLEL PROGRAMMING

Fundamental concepts – Designing for threads – Scheduling - Threading and parallel Programming constructs – Synchronization – Critical sections – Deadlock - Threading APIs.

#### UNIT III MEMORY PROGRAMMING

OpenMP – Threading a loop – Thread overheads – Performance issues – Library functions–Solutions to parallel programming problems – Cache memories (address mapping, line size, replacement and write-back policies) – Memory and cache related issues.

#### UNIT IV MPI PROGRAMMING

MPI Model – Collective communication – Data decomposition – Communicators and topologies – Interconnection networks – Buses, crossbar-Multi-stage switches – Point-to-point communication – MPI Library.

#### UNIT V MULTITHREAD AND STORAGE APPLICATION

Algorithms, program development and performance tuning-Advanced topics in disk storage-Video control–I/O Performance–SMART technology and fault detection–Processor to network interfaces.

TOTAL :( L: 45 ) = 45 PERIODS

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- 1. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.
- 2. Michael J Quinn, Parallel programming in C with MPI and OpenMP, Tata McGraw Hill, 2003.
- 3. John L. Hennessey and David A. Patterson, "Computer architecture A quantitative approach", Morgan Kaufmann/Elsevier Publishers, 4<sup>th</sup> ed., 2007.
- 4. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A hardware/ Software Approach", Morgan Kaufmann/Elsevier Publishers, 1999.



#### **17CPP01 DATA STRUCTURES LABORATORY**

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#### PREREQUISITE: NIL

### COURSE OBJECTIVES AND OUTCOMES:

| Course Objectives |  |     | Course Outcomes   | Related<br>Program<br>outcomes |
|-------------------|--|-----|---|--------------------------------|
| 1.0               | To design and implementation of various basic and advanced data structures.      | 1.1 | Student will be able to formulate new solutions for programming problems  | 1,2,3,6,7,8,<br>9,10,11,12     |
| 2.0               | To introduce various techniques for representation of the data in the real world | 2.1 | The students will be able to identify<br>the appropriate data structure for<br>given problem.   | 1,2,3,5,6,7, 8,<br>9,10,11,12  |
| 3.0               | To develop application using data structures.                                    | 3.1 | The students will have practical knowledge on the application of data structures.   | 1,2,3,6,7,8,<br>9,10,11,12     |
| 4.0               | To learn about the management of data.   | 4.1 | Student will be able to handle<br>operations like searching, insertion,<br>deletion, traversing mechanism etc.<br>on various data structures. | 1,2,3,5,6,7, 8,<br>9,10,11,12  |
| 5.0               | To improve the logical ability   | 5.1 | Student will be able to determine and demonstrate divide and conquer operations with data structures.   | 1,2,3,5,6,7, 8,<br>9,10,11,12  |

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#### LIST OF EXPERIMENTS:

- 1. Implementation of the following Heap Structures
  - i) Min Heap Deaps( Insertion, Delete Min, Delete Max)
  - ii) Skew Heap(Priority Queue operations)
  - iii) Fibonacci Heap(Priority Queue operations).
- 2. Implementation of the following Search Structures
  - i) AVL Trees (Insertion, Deletion and Search)
  - ii) Splay Trees (Insertion, Deletion and Search)
  - iii) B-Trees (Insertion, Deletion and Search)
  - iv) Red- Black Trees.
- 3. Implementation of Convex Hull.
- 4. Implementation of Topological sort.

#### TOTAL :( P: 60 ) = 60 PERIODS

|                   |  |     |   | L                                       | Т                       | Р                           | С             |
|-------------------|--|-----|---|---|-------------------------|-----------------------------|---------------|
|                   |  |     |   | 3                                       | 1                       | 0                           | 4             |
| PREREC            | QUISITE: NIL   |     |   |   |                         |                             |               |
| COURS             | E OBJECTIVES AND OUTCOMES:   |     |   |   |                         |                             |               |
| Course Objectives |  |     | Course Outcomes   |   |                         | Relate<br>Prograr<br>outcom | d<br>n<br>Ies |
| 1.0               | To employ basic XML specifications, technologies and applications.   | 1.1 | The student will be able to web page and identify its and attributes.   | analyze<br>elemer                       | ; a<br>nts 1            | l, <b>2,3,6,</b> 9          | ),11          |
| 2.0               | To understand about the XML schema and query.  | 2.1 | The student will be able to<br>XML Presentation<br>Publishing (POP) applica<br>XML Message Oriented M<br>(MOM) applications | Relate<br>Orient<br>tions a<br>1iddlewa | to<br>ed<br>nd<br>are 8 | 1,2,3,4,6<br>;,9,10,11      | 5,7,<br>I,12  |
| 3.0               | To learn about SOAP and WSDL implementations.  | 3.1 | The student will be able to<br>web services using SOAP a<br>technologies.   | o devel<br>and WSI                      | op<br>DL <b>1</b> ,     | 4,7,10,1                    | 1,12          |
| 4.0               | To describe web service, supporting<br>specifications and technologies<br>including SOAP and UDDI, UDDI,<br>JAX-RPC. | 4.1 | The student will be able to b<br>consume web services usin<br>and UDDI, UDDI, JAX-RPC.                                      | uild and<br>g SOAF                      | 1<br>2<br>1,            | 4,7,10,1                    | 1,12          |
| 5.0               | To learn to develop applications using JAX and RPC.  | 5.1 | The student will be able to client server applications u and RPC.   | impleme<br>Jsing J                      | ent<br>AX <b>1</b> ,    | 4,7,10,1                    | 1,12          |

17CPB04 WEB SERVICES

#### UNITI- XML

**20** | P a g e

XML Basis – XML Namespace – Working with DTD: Validating your XML document – Defining DTD Entities – Working with Attributes – Adding Style – XSL Transformations.

#### UNIT II - XML SCHEMA AND QUERY

Using Schema: Schema Elements, Types and Groups – Defining Schema Attributes – XML Query – XLink – XPointer.

#### UNIT III - WEB SERVICES: SOAP & WSDL

Web Services SOAP: – Structure of SOAP – SOAP Namespaces – SOAP Headers – SOAP Body – SOAP Messaging Modes – SOAP Faults – SOAP over HTTP. WSDL: Structure of WSDL – WSDL Declarations – WSDL Abstract Interface – Messaging Exchange patterns – WSDL Implementation.

#### **UNIT IV - WEB SERVICES: UDDI**

UDDI: Introduction – Data structures – Business Entity Structure - Business Service and Binding Template Structures – tModel Structure – UDDI Inquiry API – Operations – UDDI Publishing API.

#### UNIT V - WEB SERVICES: JAX – RPC

JAX- RPC: Overview – JAX-RPC Service Endpoints – JAX-RPC EJB Endpoints - JAX-RPC Clients APIs. SAAJ: Creating a SOAP Message – Working with SOAP Documents – Working with SOAP Faults – Sending SOAP messages with SAAJ.

TOTAL :( L: 45 ,T:15) = 60 PERIODS

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#### **REFERENCES:**

- 1. Heather Williamson, "The Complete Reference XML", TMH, 2001.
- 2. Richard Monson-Haefel, "J2EE Web Services", 8th ed., Person Education, 2012.



#### 17CPB05 ADVANCED DATABASE TECHNOLOGY

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## PREREQUISITE: NIL

### COURSE OBJECTIVES AND OUTCOMES:

|     | Course Objectives   |     | Course Outcomes  | Related Program<br>outcomes |
|-----|---|-----|--|-----------------------------|
| 1.0 | To acquire knowledge on parallel<br>and distributed databases and its<br>applications.                      | 1.1 | The students will be able to select the appropriate high performance database like parallel and distributed database.              | 1,2,4,10                    |
| 2.0 | To study the usage and applications of Object Oriented database   | 2.1 | The students will be able to model and<br>represent the real world data using<br>object oriented database.                         | 1,3,4,5,7, 9,11,12          |
| 3.0 | To understand the usage of advanced data models.  | 3.1 | The students will be able to design a semantic based database to meaningful data access  | 2,7,8,10                    |
| 4.0 | To gain knowledge about<br>intelligent databases  | 4.1 | The students will be able to embed<br>the rule set in the database to<br>implement intelligent databases.                          | 1,3,4,7,9                   |
| 5.0 | To acquire inquisitive attitude<br>towards research topics in<br>databases like cloud database<br>and NoSQL | 5.1 | The students will be able to demonstrate competency in designing and selecting a particular NoSQL database for specific use cases. | 4,7,8,9,10,11,12            |

#### UNIT I PARALLEL DATABASES

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems.

#### UNIT II DISTRIBUTED DATABASES

Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies.

#### UNIT III OBJECT BASED DATABASES

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL.

#### UNIT IV INTELLIGENT DATABASES

Active Databases: Syntax and Semantics -Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- Deductive Databases: Logic of Query Languages – Data log-Recursive Rules-Syntax and Semantics of Data log Languages- Implementation of Rules and Recursion-Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Mobile Databases.

#### UNIT V CLOUD DATABASE AND NOSQL

Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models-Query Languages- Introduction to Big Data-Storage- NoSQL Introduction – Differences from relational databases – Column family store- Document stores – key-value databases – Graph databases – Choosing a NoSQL database.

#### TOTAL :( L: 45 ,T=15) = 60 PERIODS

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#### REFERENCES

- 1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", 6<sup>th</sup> ed., Pearson Education/Addison Wesley.
- 2. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", 6<sup>th</sup> ed., Pearson Education.
- 3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 6<sup>th</sup> ed., McGraw Hill.
- 4. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", 8th ed., Pearson Education.
- 5. Pramod J. Sadalage, Martin Fowler, "NoSQL Distilled: A Brief Guide to the Emerging of Polyglot Persistence", Addison-Wesley, 2012.



#### 17CPB06 SECURITY PRINCIPLES AND PRACTICES

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### PREREQUISITE: NIL

#### COURSE OBJECTIVES AND OUTCOMES:

|     | Course Objectives  |     | Course Outcomes   | Related<br>Program<br>outcomes |
|-----|--|-----|---|--------------------------------|
| 1.0 | To understand the mathematical                               | 1.1 | The students will be able to  | 1                              |
|     | roundations of security principles                           |     | foundations of security principles  |                                |
| 2.0 | To understand block cipher and stream cipher models          | 2.1 | The students will be able to<br>understand block cipher and stream<br>cipher models         | 5                              |
| 3.0 | To appreciate the different aspects of encryption techniques | 3.1 | The students will be able to appreciate the different aspects of encryption techniques      | 5,6                            |
| 4.0 | To understand the role played by authentication in security  | 4.1 | The students will be able to<br>understand the role played by<br>authentication in security | 1,5,6,9,11,12                  |
| 5.0 | To appreciate the current trends of<br>security practices    | 5.1 | The students will be able to appreciate the current trends of security practices            | 9,11,12                        |

#### UNIT I CLASSICAL CIPHERS

Classical Cryptography- Shift Cipher - Substitution Cipher - Affine Cipher - Cryptanalysis - Cryptanalysis of the Affine Cipher - Cryptanalysis of the Substitution Cipher - Cryptanalysis of the Vigenere Cipher - Shannon<sup>\*\*</sup>s Theory

#### UNIT II SYMMETRIC CIPHERS AND HASH FUNCTIONS

Substitution-Permutation Networks - Linear Cryptanalysis - Differential Cryptanalysis – Data Encryption Standard - Advanced Encryption Standard - Modes of Operation -Cryptography Hash Function - Hash Function and Data Integrity - Security of Hash Function - Iterated Hash Functions - Message Authentication Codes

#### UNIT III PUBLIC-KEY ENCRYPTION TECHNIQUES

Introduction to Public-key Cryptography - Number theory - RSA Cryptosystem - Attacks on RSA - El-Gamal Cryptosystem - Shanks<sup>\*\*</sup> Algorithm - Elliptic Curves over the Reals - Elliptical Curves Modulo a Prime - Signature Scheme - Digital Signature Algorithm

#### UNIT IV KEY MANAGEMENT

Identification Scheme and Entity Authentication - Challenge and Response in the Secret-key Setting - Challenge and Response in the Public key Setting - Schnorr Identification Scheme – Key distribution - Diffie-Hellman Key - Pre-distribution - Unconditionally Secure key Pre-distribution - Key Agreement Scheme - Diffie-Hellman Key agreement - Public key infrastructure - PKI, Certificates, Trust Models

#### UNIT V SECURITY PRACTICES

24 | P a g e

Transport-Level Security – SSL – TLS - HTTPS – SSH - Electronic Mail Security - Pretty Good Privacy - IP Security - IP Security Architecture – Authentication Header – Encapsulating Security Payload – Key Management - Legal and Ethical Issues

#### TOTAL :( L: 45 ) = 45 PERIODS

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#### **REFERENCES:**

- 1. Douglas R. Stinson, "Cryptography Theory and Practice", Third Edition, Chapman & Hall/CRC, 2006.
- 2. William Stallings, "Cryptography and Network Security: Principles and Practices", 6th ed., Pearson Education, 2013.
- 3. Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 2003.
- 4. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", 4th ed., Pearson Education, 2007.
- 5. Wade Trappe and Lawrence C. Washington, "Introduction to Cryptography with Coding Theory", 2<sup>nd</sup> ed., Pearson Education, 2007.



|                   |  |     |  | L                          | T                | P                          | C              |  |  |
|-------------------|--|-----|--|----------------------------|------------------|----------------------------|----------------|--|--|
|                   |  |     |  | 3                          | 2                | 0                          | 4              |  |  |
| PREREC            | QUISITE: NIL   |     |  |                            |                  |                            |                |  |  |
| COURS             | E OBJECTIVES AND OUTCOMES:   |     |  |                            |                  |                            |                |  |  |
| Course Objectives |  |     | Course Outcomes  |                            |                  | Relate<br>Progra<br>outcon | ed<br>m<br>nes |  |  |
| 1.0               | To understand how an operating<br>system performs its duties is to garner<br>insight into how a computer functions at<br>its innermost levels.                 | 1.1 | The students will be<br>understand the potential be<br>distributed operating systems | able<br>enefits<br>s.      | to<br>of         | 1,2,3,7<br>9,10,11         | ,8,<br>,12     |  |  |
| 2.0               | To learn a multiprogramming system, distributed operating systems.   | 2.1 | The students will be<br>implement various c<br>operating system concepts.            | able<br>distribut          | to<br>ed         | 1,2,3,4,<br>8,9,10,1       | 5,7,<br>1,12   |  |  |
| 3.0               | To learn the principles of managing the<br>main memory, one of the most precious<br>resources in mechanisms of<br>synchronization and resource<br>management,. | 3.1 | The students will be able to various resources efficiently distributed processes.    | o alloca<br>for all t      | ate<br>he        | 1,2,3,5<br>8,10,11         | ,7,<br>,12     |  |  |
| 4.0               | To gain knowledge about the fault recovery and fault tolerance mechanisms of operating system.   | 4.1 | The students will be able to<br>with protection and<br>mechanisms of operating       | famili<br>securi<br>systen | iar<br>ity<br>n. | 1,2,3,5<br>8,10,11         | ,7,<br>,12     |  |  |
| 5.0               | To provide exposure on database operating system.  | 5.1 | The students will be able to<br>the requirements of o<br>operating systems.          | o ident<br>databa          | ify<br>se        | 1,2,3,5<br>8,10,11         | ,7,<br>,12     |  |  |

17CPB07 ADVANCED OPERATING SYSTEMS

### **UNIT I - PROCESS SYNCHRONIZATION**

Overview - Functions of an Operating System - Design Approaches - Types of Advanced Operating System -Synchronization Mechanisms - Concept of a Process, Concurrent Processes - The Critical Section Problem, Other Synchronization Problems - Language Mechanisms for Synchronization - Axiomatic Verification of Parallel Programs - Process Deadlocks - Preliminaries - Models of Deadlocks- Resources - A Graph-Theoretic model of System State - Necessary and Sufficient conditions for a Deadlock - Systems with Single-Unit Requests, Consumable Resources. Reusable Resources.

#### **UNIT II - DISTRIBUTED OPERATING SYSTEMS**

Issues - Communication Networks and Primitives - Theoretical Foundations - Inherent Limitations - Lamport"s Logical Clock- Vector Clock- Causal Ordering of Messages- Global State- Distributed Mutual Exclusion -Classification- Preliminaries - Non-Token Based Algorithms - Lamport"s Algorithm - Token-Based Algorithms -Suzuki-Kasami"s Broadcast Algorithm- Distributed Deadlock Detection- Preliminaries - Handling of Deadlocks -Issues -Centralized Deadlock-Detection Algorithms - Distributed Deadlock Detection Algorithms - Hierarchical Deadlock Detection Algorithms.

#### **UNIT III - DISTRIBUTED RESOURCE MANAGEMENT**

Distributed file system - Architecture-Design issues-Distributed Shared Memory- Algorithms for implementing DSM -Memory Coherence and Coherence Protocols - Design Issues- Distributed Scheduling - Issues in Load Distributing - Components of a Load Distributing Algorithm - Stability - Load Distributing Algorithm - Performance Comparison -

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Selecting a Suitable Load Sharing Algorithm – Requirements for Load Distributing - Task Migration and Issues.

#### **UNIT IV - FAILURE RECOVERY AND FAULT TOLERANCE**

Recovery : Introduction – Basic Concepts – Classification of Failures – Backward and Forward Error Recovery Approaches - Recovery in Concurrent Systems – Synchronous and Asynchronous Check Pointing and Recovery – Check Pointing for Distributed Database Systems - Recovery in Replicated Distributed Databases Systems – Fault Tolerance – Issues- Commit Protocol- Non Blocking Commit Protocol-Voting Protocol - Dynamic Voting Protocol – Dynamic Vote Reassignment Protocol – Failure Resilient Processes – Reliable Communication.

#### UNIT V - DATABASE OPERATING SYSTEMS

Introduction- Requirements of a Database Operating System- Concurrency Control: Theoretical Aspects – Database Systems – The Problem of Concurrency Control – Serializability. Theory- Distributed Database Systems-Concurrency Control Algorithms- Basic Synchronization Primitives – Lock Based Algorithms - Timestamp Based Algorithms - Optimistic Algorithms – Data Replication.

#### TOTAL (L:45+T:30) =75 PERIODS

#### **REFERENCES**:

- 1. Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill, 2011.
- Abraham Silberschatz, Peter B. Galvin and G. Gagne, "Operating System Concepts", 9th ed., Addison Wesley Publishing Co., 2013.
- 3. Andrew S. Tanenbaum, "Modern Operating Systems", 2<sup>nd</sup> ed., Addison Wesley, 2001.
- 4. Pradeep K.Sinha, "Distributed operating system -Concepts and design", PHI, 2007.
- 5. Andrew S.Tanenbaum, "Distributed operating system", Pearson education, 2013.



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| 17CPP02 DATABASE TECHNOLOGY LABORATORY |   |     |  |                              |                |                            |                |
|--|---|-----|--|------------------------------|----------------|----------------------------|----------------|
|  |   |     |  | L                            | Т              | Р                          | С              |
|  |   |     |  | 0                            | 0              | 4                          | 2              |
| PREREC                                 | QUISITE: NIL  |     |  |                              |                |                            |                |
| COURS                                  | E OBJECTIVES AND OUTCOMES:  | 1   |  |                              |                |                            |                |
|  | Course Objectives   |     | Course Outcomes  |                              |                | Relate<br>Progra<br>outcon | ed<br>m<br>nes |
| 1.0                                    | To develop an understanding of corporate data resources and their value for modern businesses   | 1.1 | The students will be able to<br>and Apply Advanced<br>Development Techniques.<br>Database Systems. | o evalua<br>Databa<br>Evalua | te<br>se<br>te | 1,2,4,7<br>9,11,1          | ′,8,<br>I2     |
| 2.0                                    | To collect, analyze and consolidate relevant information from many sources.   | 2.1 | The students will be<br>administer Database System   | able<br>ıs.                  | to             | 1,3,4,5<br>9,10,11         | ,7,<br>,12     |
| 3.0                                    | To use the collected information in<br>supporting claims about the<br>advantages and disadvantages of<br>corporate data management tools<br>and techniques. | 3.1 | The students will be able to<br>implement advanced<br>systems.                                     | o design<br>databa           | &<br>se        | 2,3,5,<br>8,10             | 7,             |

#### LIST OF EXPERIMENTS:

- 1. Create a distributed database and do some basic SQL on that database.
- 2. Implement deadlock detection algorithm for distributed database using wait-for graph.Produce local wait for graph for each of the sites and construct global wait for graph and check for dead lock.
- 3. Design an Enhanced Entity Relationship (EER) Model and Write relevant OQL.
- 4. Implement a application using parallel database [State any assumptions you have made].
- 5. Implement parallel join and parallel sort algorithms in a parallel database.
- 6. Design a relational database schema and implement some relevant triggers and assertions to make that database as active database.
- 7. Construct a knowledge database for kinship domain (family relations) with facts. Extract the following relations using rules. Parent, Sibling, Brother, Sister, Child, Daughter, Son, Spouse, Wife, husband, Grandparent, Grandchild, Cousin, Aunt and Uncle.
- 8. Implement Query Optimizer with Relational Algebraic expression construction and execution plan generation for choosing an efficient execution strategy for processing the given query.

#### Use Eucalyptus or Open Nebula or equivalent to set up the cloud and demonstrate:

- 9. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
- 10. Find procedure to set up the one node Hadoop cluster.
- 11. Write a word count program to demonstrate the use of Map and Reduce tasks.

#### TOTAL :( P: 60 ) = 60 PERIODS

| 17CPE01 TECHNICAL TERM PAPER  |   |  |   |  |      |                                |   |              |
|---|---|--|---|--|------|--------------------------------|---|--------------|
|   |   |  |   |  | L    | T                              | Ρ | C            |
|   |   |  |   |  | 0    | 0                              | 2 | 1            |
| PREREQUISITE: NIL   |   |  |   |  |      |                                |   |              |
| COURSE  | OBJECTIVE   | S AND OUTCOMES:  |   |  |      |                                |   |              |
| Course Objectives   |   |  | Course Outcomes   |  |      | Related<br>Program<br>outcomes |   |              |
| <b>1.0</b> To provide exposure to the students to refer, read and review the research articles in referred journals and conference proceedings. |   |  | nts <b>1.1</b><br>the<br>als  | 1.1At the end of the course the student<br>will be able to read and review the<br>research articles and publish a<br>technical paper1,2,3,5,6,7<br>8,9,10,11,1 |      |                                |   | 6,7,<br>1,12 |
| METHO   | DOLOGY  | <ul> <li>Each student is</li> <li>By mutual disc<br/>to the student.</li> <li>The students is<br/>published litera</li> <li>The student is<br/>last 5 years.</li> <li>Using OHP/Po<br/>followed by 10</li> <li>The student ha<br/>end of the sem</li> <li>The student h<br/>page Abstract<br/>Remarks and<br/>Dean/ HOD of<br/>guide.</li> </ul> | <ul> <li>Each student is allotted to a faculty of the department by the Dean/ HOD.</li> <li>By mutual discussions, the faculty guide will assign a topic in the general /subject area to the student.</li> <li>The students have to refer the Journals and Conference proceedings and collect the published literature.</li> <li>The student is expected to collect atleast 20 such Research Papers published in the last 5 years.</li> <li>Using OHP/Power Point, the student has to make presentation for 15 -20 minutes followed by 10 minutes discussion.</li> <li>The student has to make two presentations, one at the middle and the other near the end of the semester.</li> <li>The student has to write a Technical Report for about 30 -50 pages (Title page, one page Abstract, Review of Research paper under various subheadings, Concluding Remarks and List of References). The technical report has to be submitted to the Dear(LIOD are work) before the fact the</li></ul> |  |      |                                |   |              |
| EXEC  | UTION   | Week           I           II           III-IV           V-VI           VII-VIII           IX  | Activity<br>Allotment of Faculty Guide by the Dean/ HoD<br>Finalizing the topic with the approval of Faculty Guide<br>Collection of Technical papers<br>Mid semester presentation<br>Report writing<br>Report submission  |  |      |                                |   |              |
|   | X-XI         Final presentation           100% by Continuous Assessment         - 3 Hrs/week and 1 credit |  |   |  |      |                                |   |              |
| EVALUATION  |   | Mid semester presen<br>Final presentation (In<br>End Semester Exami<br>Presentation  | tation<br>ternal)<br>nation Report  | 25%<br>25%<br>t 30%<br>20%   |      |                                |   |              |
|   |   | <b>Total</b> 100   |   |  | 100% |                                |   |              |



| Approved | b y | Eighth | Academic | Сои |
|----------|-----|--------|----------|-----|

2. Douglas E Comer and David L. Stevens, "Internetworking with TCP/IP Vol. II: ANSI C Version: Design, Implementation and Internals II, 3<sup>rd</sup> ed., 1998.

3. W.Richard Stevens, "TCP/IP Illustrated" Vol. 1, Pearson Education, 2012.

4. W.Richard Stevens, "TCP/IP Illustrated" Vol. 2, Pearson Education, 2003.

#### **REFERENCES:** 1. Douglas E Comer, "Internetworking with TCP/IP Principles, Protocols and Architecture", Vol. 1, 5th ed.,

**30** | P a g e

2006.

# UNIT V TCP IMPLEMENTATION II

retransmission - persist timer - keep alive timer. (9)

UNIT II TCP

- AARP - RARP- IP- IP Routing - ICMP - IPV6..

Services - header - connection establishment and termination - interactive data flow - bulk data flow - timeout and

Internetworking concepts and architecture model - classful Internet address - CIDR - Subnetting and Supernetting

IP global software organization -routing table-routing algorithms - fragmentation and reassembly -error processing

INTRODUCTION

UNIT III IP IMPLEMENTATION

# (ICMP) – Multicast Processing (IGMP).

UNIT IV TCP IMPLEMENTATION I (9) Data structure and input processing - transmission control blocks - segment format - comparison-finite state

# machine implementation – Output processing – mutual exclusion – the computing the TCP Data length.

Timers – events and messages – timer process – deleting and inserting timer event – flow control and adaptive retransmission- congestion avoidance and control - urgent data processing and push function.

#### 4.0 To learn to design and implement

services

PREREQUISITE: NIL

То

1.0

2.0

3.0

UNIT I

COURSE OBJECTIVES AND OUTCOMES:

**Course Objectives** 

internetworking, IP and TCP

the

To understand the fundamentals of

network design and implementation.

design

application

understand

To interpret TCP/IP

|     | network applications.  |     | trade-offs between UDP and TCP and uses.                      |
|-----|--|-----|---|
| 5.0 | To gain knowledge on how<br>efficiently transmit data within the<br>stipulated time. | 5.1 | The student will be able to transmit data without congestion. |

# 17CPX01 TCP/IP TECHNOLOGY

1.1

2.1

3.1

4.1

protocols

of

**Course Outcomes** 

The student will be able to gain practical

experience in designing communication

The student will be able to outline the

The student will be able to gain practical

experience of IP addresses, and the

The student will be able to build the

between UDP and TCP and its

various ways of connecting a network

fundamentals of IP routing

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Related

Program outcomes

1,4,7,8,10

2,3,6,10,11,

12

1,2,4,5,9

1,3,4,8,9,10

1,3,4,8,9,10

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TOTAL :( L: 45 ) = 45 PERIODS

### (9)

ncil

#### research and application. its applications. To explain the role of finding The student will be able to evaluate and 2.1 associations in commercial implement a wide range of emerging and market basket data. newly-adopted methodologies technologies to facilitate the knowledge discovery Discover and measure interesting patterns from different kinds of databases. The student will be able to discuss the role of To characterize the kinds of 3.1 patterns that can be discovered data warehousing and enterprise intelligence by association rule mining. in industry and government.

# UNIT I DATA WAREHOUSING

rules.

PREREQUISITE: 17CPB05

То

1.0

2.0

3.0

4.0

5.0

COURSE OBJECTIVES AND OUTCOMES:

**Course Objectives** 

compare

and

different conceptions of data

mining as evidenced in both

To describe how to extend a

relational system to find

patterns using association

To learn the importance of

algorithms and recent trends.

unsupervised learning

contrast

1.1

4.1

5.1

Data Warehousing and Business Analysis: - Data warehousing Components -Building a Data warehouse - Mapping the Data Warehouse to a Multiprocessor Architecture - DBMS Schemas for Decision Support - Data Extraction, Cleanup, and Transformation Tools -Metadata - reporting - Query tools and Applications - Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

### UNIT II DATA MINING AND PREPROCESSING

Data Mining: - Data Mining Functionalities - Data Pre-processing - Data Cleaning - Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods - Mining Various Kinds of Association Rules - Association Mining to Correlation Analysis – Constraint- Based Association Mining.

### UNIT III FREQUENT PATTREN MINING

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Classification and Prediction: - Issues Regarding Classification and Prediction - Classification by Decision Tree Introduction - Bayesian Classification - Rule Based Classification - Classification by Back propagation - Support Vector Machines - Associative Classification - Lazy Learners - Other Classification Methods - Prediction -Accuracy and Error Measures - Evaluating the Accuracy of a Classifier or Predictor - Ensemble Methods - Model Section.

| 17CPX02 DATA WAREHOUSING AND DATA MINING |   |
|--|---|
|  | Γ |

**Course Outcomes** 

The student will be able to learn the concepts

of database technology evolutionary path

which has led to the need for data mining and

The student will be able to summarize the

dominant data warehousing architectures and

The student will be able to apply and work with

clustering algorithms and recent trends.

their support for quality attributes.

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Related

Program outcomes

4,5,7,8,9,

10,11,12

2,4,8,10,11,1

2

3,4,5,6,8,9

2,3,5,6,7

2,3,5,6,7

and

(9)

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#### UNIT IV CLASSIFICATION AND PREDICTION

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint- Based Cluster Analysis – Outlier Analysis.

#### UNIT V CLUSTERING AND TRENDS IN DATA MINING

Mining Object, Spatial, Multimedia, Text and Web Data-Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.

#### TOTAL :( L: 45 ) = 45 PERIODS

#### **REFERENCES:**

- 1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 3<sup>rd</sup> ed., Elsevier, 2012.
- Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill Edition, 10th Reprint, 2007.
- 3. K.P. Soman, Shyam Diwakar and V. Ajay, "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
- 4. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, PH of India, 2006.
- 5. Pang-Ning Tan, Michael Steinbach & Vipin Kumar, "Introduction to Data Mining", Pearson Edu. 2007.

| 17CPX03 DISTRIBUTED SYST |
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#### PREREQUISITE: 17CPB07

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# COURSE OBJECTIVES AND OUTCOMES:

| Course Objectives |  | Course Outcomes |   | Related Program<br>outcomes |
|-------------------|--|-----------------|---|-----------------------------|
| 1.0               | To learn distributed system<br>and operating system.                       | 1.1             | The students will be able to present the main<br>characteristics of distributed systems, as well<br>as the related problems and the most common<br>solutions. | 1,5,7,9                     |
| 2.0               | To understand threads in distributed system.                               | 2.1             | The students will be able to implement small-<br>scale distributed systems.   | 3,5,8                       |
| 3.0               | To analyze the performance<br>of synchronization in<br>distributed systems | 3.1             | The students will be able to synchronize all the process in a distributed system  | 3,5,8,11,12                 |
| 4.0               | To learn knowledge about<br>synchronization and fault<br>tolerance.        | 4.1             | The students will have clear understanding of fault tolerance.  | 11,12                       |
| 5.0               | To learn about file system<br>in distributed system                        | 5.1             | The students will be able to explore about various file systems.  | 11,12                       |

#### UNIT I INTRODUCTION

Definition of Distributed system - Goals- Hardware concepts: Multiprocessors, Homogeneous and Heterogeneous multicomputer systems- Software concepts: Distributed Operating Systems, Network operating systems and Middleware - Client server model.

#### UNIT II COMMUNICATION AND PROCESSES

Layered Protocol - Remote procedure call - Remote object invocation - Message oriented communication -Processes: Threads in distributed systems- Code Migration-Software Agents.

#### UNIT III SYNCHRONIZATION

Clock synchronization - Physical clocks- Logical clocks- Election algorithms- Mutual exclusion - Distributed transactions.

### UNIT IV FAULT TOLERANCE

Basic concepts - Design Issues- Reliable client server communication- Reliable group communication. Distributed object based systems: CORBA - Distributed COM - GLOBE - Comparison of CORBA, DCOM and GLOBE.

#### UNIT V DISTRIBUTED FILE SYSTEM

Sun Network File system- CODA File system – XFS and SFS File system. Distributed document based systems: WWW - LOTUS NOTES.

#### TOTAL :( L: 45 ) = 45 PERIODS

#### **REFERENCES:**

- 1. Andrew S. Tanenbaum and Maarten Van Steen, "Distributed Systems Principles and Paradigms", Prentice Hall of India Pvt. Ltd, New Delhi, 2009.
- 2. George Coulouris, Tim Kindberg and Jean Dollimore, "Distributed Systems Concept and Design", Pearson Education, New Delhi, 2005.
- 3. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufmann Publishers, New Delhi, 2000.

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# UNIT I WIRELESS COMMUNICATION TECHNOLOGIES Cellular networks, wireless 802.11, TCP/IP for mobile, Geo location and Geo positioning systems.

# UNIT II OVERVIEW OF MOBILE COMPUTING

PREREQUISITE: 17CPA02

Overview of Mobile Technologies, Anatomy of mobile device, survey of mobile device, Applications of mobile device, Native vs Mobile applications, Architecture.

# UNIT III DEVELOPMENT ENVIRONMENT

Introduction to Objective-C, Model view Controller Model, Mobile computing Software framework, Android SDK, iPhone SDK, Common user interface guidelines.

# UNIT IV MOBILE COMPUTING STRATEGIES

Application Environment, Limited Resource Computing, Mobile Memory management, Low power Computing, Fault tolerance and Persistence, Security Issues.

# UNIT V FUTURISTIC COMPUTING

34 | Page

Upcoming Technologies, Convergence of Media and Communication devices, Case Studies.

TOTAL :( L: 45 ) = 45 PERIODS

COURSE OBJECTIVES AND OUTCOMES:

| Course Objectives |   |     | Course Outcomes  | Related<br>Program<br>outcomes |
|-------------------|---|-----|--|--------------------------------|
| 1.0               | To have deep knowledge about wireless communication and mobile technologies | 1.1 | The students will be able to understand<br>the concept of wireless communication and<br>mobile technologies    | 1,2,3,7,8,<br>9,10,11,12       |
| 2.0               | To understand the basic concepts of mobile computing                        | 2.1 | The students will be able to develop applications that are used in mobile device using SDK                     | 1,4,5,7,8,<br>9,10,11          |
| 3.0               | To understand the different development environments                        | 3.1 | The students will be able to develop applications that are used in mobile device using different environments. | 1,2,3,4,5,7,8<br>, 9,10,11,12  |
| 4.0               | To identify the pros and cons of different mobile computing strategies.     | 4.1 | The students will be able to develop applications with renowned features.                                      | 1,4,5,7,8,<br>9,10,11,12       |
| 5.0               | To know the future trends in mobile technologies                            | 5.1 | The students will be able to develop mobile applications with all advanced features.                           | 1,4,5,7,8,<br>9,10,11,12       |

# **17CPX04 MOBILE COMPUTING**

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#### **REFERENCES:**

- 1. Asoke K Taukder, Roopa R Yavagal, "Mobile Computing", Tata McGraw Hill Publication Co., New Delhi, 2010.
- 2. Ivan Stojmenovic, "Handbook of Wireless Networks and Mobile Computing", John Wiley & sons Inc, Canada, 2006.
- 3. Jonathan Loo, Jaime Lloret Mauri, Jesús Hamilton Ortiz, "Mobile Ad Hoc Networks: Current Status and Future Trends" 2012.
- 4. J.Schiller, "Mobile Communication", Addison Wesley, 2009.
- 5. William Stallings, "Wireless Communication and Networks", Pearson Education, 2003.



|   | Course Objectives  |     | Course Outcomes   | Related<br>Program<br>outcomes |  |  |  |
|---|--|-----|---|--------------------------------|--|--|--|
| 1.0   | Deliver successful software<br>projects that support<br>organization's strategic goals   | 1.1 | The students will be able to provide how different project contexts will impact upon all aspects of a software development project  | 1,2,3,7,8,<br>9,10,11,12       |  |  |  |
| 2.0   | Match organizational needs to<br>the most effective software<br>development model  | 2.1 | The students will be able to identify and describe the key phases of project management and the key skills associated   | 1,4,5,7,8,<br>9,10,11,12       |  |  |  |
| 3.0   | Plan and manage projects at<br>each stage of the software<br>development life cycle (SDLC)<br>Create project plans that<br>address real-world<br>management challenges | 3.1 | The students will be able to determine an appropriate project management approach through an evaluation of the business context and project scope and knowledge of agile and traditional project management approaches                                      | 1,2,3,4,5,7,8,<br>9,10,11,12   |  |  |  |
| 4.0   | Develop the skills for tracking<br>and controlling software<br>deliverables.   | 4.1 | The students will be able to demonstrate<br>through application, knowledge of the key<br>project management skills, such as product and<br>work break-down structure, schedule;<br>governance including progress reporting, risk<br>and quality management. | 2,4,6,7,8,<br>10,11            |  |  |  |
| 5.0   | To manage the people behavioral aspects in the organization.   | 5.1 | The students will be able to obtain character based project learning  | 2,4,6,7,8,<br>10,11,12         |  |  |  |
| UNIT I BASIC CONCEPTS       (9)         Product, Process and Project – Definition – Product Life Cycle – Project Life Cycle Models       (9)         UNIT II FORMAT PROCESS MODELS AND THEIR USE       (9)         Definition and Format model for a process – The ISO 9001 and CMM Models and their relevance to Project Management – Other Emerging Models like People CMM. |  |     |   |                                |  |  |  |
| UNIT III<br>Metrics –   | UNIT III UMBRELLA ACTIVITIES IN PROJECTS         (9)           Metrics – Configuration Management – Software Quality Assurance – Risk Analysis.         (9)            |     |   |                                |  |  |  |
|   | UNIT IV IN STREAM ACTIVITIES IN PROJECTS (9)   |     |   |                                |  |  |  |

**17CPX05 SOFTWARE PROJECT MANAGEMENT** 

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Project Initiation – Project Planning – Execution and Tracking – Project Wind up – Concept of Process/Project Database.

## UNIT V ENGINEERING AND PEOPLE ISSUES IN PROJECT MANAGEMENT

Phases (Requirements, Design, Development, Testing, Maintenance, Deployment) – Engineering Activities and Management Issues in Each Phase – Special Considerations in Project Management for India and Geographical Distribution Issues.

# TOTAL :( L: 45 ) = 45 PERIODS

(9)

PREREQUISITE: NIL

COURSE OBJECTIVES AND OUTCOMES:
- Ramesh, Gopalaswamy, "Managing Global Software Projects", Tata McGraw Hill, 2008.
   Humphrey, Watts, "Managing the Software Process", Addison Wesley, 1986.
   Pressman Roger "Software Engineering A Practitioner"s approach", Tata McGraw Hill, 1997.
- 4. Bob Hughes and Mike Cotterell, "Software Project Management", 5th ed., Tata McGraw Hill, 2009.



# **17CPX06 HIGH SPEED NETWORKS**

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## PREREQUISITE: 17CPA02

# COURSE OBJECTIVES AND OUTCOMES:

|     | Course Objectives   |     | Course Outcomes  | Related<br>Program<br>outcomes |
|-----|---|-----|--|--------------------------------|
| 1.0 | To have a thorough understanding of the various Packet Switched Networks. | 1.1 | The students will have a strong foundation<br>of OSI model and various protocols used in<br>each layer | 1,2,3,7,8,<br>9,10,11          |
| 2.0 | To learn the overview of circuit switched networks                        | 2.1 | The student will be able to get an insight into circuit switched networks.                             | 1,4,5,7,8,<br>9,10,11,12       |
| 3.0 | To understand in detail about the concepts of ATM.                        | 3.1 | The student will become familiar with ATM networks and its layers.                                     | 1,2,3,4,5,7,8<br>, 9,10,11,12  |
| 4.0 | To learn the need of optical networks                                     | 4.1 | The student will be able to identify the need of optical networks.                                     | 2,4,6,7,8,<br>10,11,12         |
| 5.0 | To discuss about the Optical networks, Wi-MAX and UWB.                    | 5.1 | The student will be able to gain thorough knowledge in Wi-MAX and UWB                                  | 1,3,5,7,8,9,1<br>0,11,12       |

# UNIT I PACKET SWITCHED NETWORKS

OSI and IP models – Ethernet (IEEE 802.3) – Token ring (IEEE 802.5) – FDDI – DQDB – SMDS: Internetworking with SMDS. Wireless LAN (IEEE 802.11).

# UNIT II CIRCUIT SWITCHED NETWORKS

SONET - Dense Wave Division Multiplexing (DWDM) - Digital Subscriber Line (DSL) - Intelligent Network Architecture- CATV.

# UNIT III ATM NETWORKS

ATM: Main Features of ATM- Addressing, Signaling and Routing- ATM Header Structure- Adaptation Layer-Management and control- Internetworking with ATM.

# UNIT IV OPTICAL NETWORKS

Optical Links - WDM Systems - Optical Cross Connects - Optical LANs. Optical Paths and Networks- Ring Networks - Hierarchical Mesh Networks - Optical Networks.

# UNIT V ULTRA WIDEBAND (UWB) AND WIMAX

UWB: Introduction- Time-Hopping Ultra wide band- Direct Sequence Ultra wideband- Multiband- Other Types of UWB. WiMAX: Introduction- WiMAX Overview- Competing Technologies- Overview of the Physical Layer- PMP Mode- Mesh Mode- Multi hop Relay Mode.

# **REFERENCES:**

- 1. Walrand .J. Varatya, "High performance communication network", Morgan Kauffman Harcourt Asia Pvt. Ltd. 2<sup>nd</sup> ed., 2000.
- 2. David tung chong wong, Peng-yong kong, Ying-chang liang, Kee chaing chua and Jon W. Mark, "Wireless Broadband Networks," John Wiley & Sons, 2009.
- 3. William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", 4th ed., Pearson education Asia, 2002
- 4. Jennifer Bray and Charles F.Sturman, "Blue Tooth", Pearson education Asia, 2001



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# TOTAL :( L: 45 ) = 45 PERIODS

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|                   | 1/CPXU/ DATA SCIENCE AND BIG DATA ANALYTICS  |     |  |  |                            |                             |              |  |  |
|-------------------|--|-----|--|--|----------------------------|-----------------------------|--------------|--|--|
|                   |  |     |  | L  | Т                          | Р                           | С            |  |  |
|                   |  |     |  | 3  | 0                          | 0                           | 3            |  |  |
| PRER              | EQUISITE: 17CPB05  |     |  |  | ·                          | ·                           |              |  |  |
| COUR              | SE OBJECTIVES AND OUTCOMES:  |     |  |  |                            |                             |              |  |  |
| Course Objectives |  |     | Course Outcomes  |  | R                          | Related Program<br>outcomes |              |  |  |
| 1.0               | To Explore the fundamental concepts of big data and analytics  | 1.1 | The students will b<br>identify the need for<br>analytics for a domain.  | e able<br>r big d                              | to<br>lata                 | 1,2,5,7,8,                  | 9,10         |  |  |
| 2.0               | To learn analytical techniques and tools<br>to analyze big data, create statistical<br>models, and identify insights that can lead<br>to actionable results. | 2.1 | The students will be ab<br>the Data Analytics L<br>address big data<br>projects.   | le to dep<br>₋ifecycle<br>analy                | bloy<br>to<br>tics         | 1,2,3,4,5<br>9,10,11        | ,7,8,<br>,12 |  |  |
| 3.0               | To understand about visualization techniques and tools to analyze big data and create statistical models.  | 3.1 | The students will be at<br>appropriate data visua<br>clearly communicate<br>insights to business sp<br>analytic audiences. | ole to se<br>alizations<br>e anal<br>ponsors a | lect<br>to<br>lytic<br>and | 1,2,3,4,5<br>9,10,11        | ,7,8,<br>,12 |  |  |
| 4.0               | To analyze the big data using intelligent techniques.  | 4.1 | The students will be ab<br>efficient algorithms for<br>data from large volumes   | le to des<br>mining<br>s.                      | sign<br>the                | 1,2,3,4,5<br>9,10,11        | ,7,8,<br>,12 |  |  |
| 5.0               | To Use tools such as: R and RStudio,<br>MapReduce/ Hadoop, in-database<br>analytics, Window and MADlib functions.  | 5.1 | The students will be ab<br>applications using Ma<br>Concepts.  | le to des<br>ap Red                            | sign<br>uce                | 1,2,3,4,<br>9,10,11         | 7,8,<br>,12  |  |  |

## UNIT I INTRODUCTION TO BIG DATA ANALYTICS

Big Data overview, State of the practice in analytics role of data scientists, Big Data Analytics in industry verticals.

# UNIT II END-TO-END DATA ANALYTICS LIFE CYCLE

Key roles for successful analytic project, main phases of life cycle, Developing core deliverables for stakeholders.

## UNIT III BASIC ANALYTIC METHODS

Introduction to "R", analyzing and exploring data with "R", statistics for model building and evaluation.

# UNIT IV ADVANCED ANALYTICS AND STATISTICAL MODELING FOR BIG DATA (9)

Naïve Bayseian Classifier, K-means Clustering, Association Rules, Predictive modelling using Decision Trees, Linear and Logistic Regression, Time Series Analysis, Text Analytics.

# UNIT V MAPREDUCE/HADOOP

Technology and Tools – MapReduce/Hadoop Ecosystem - Stream Computing Challenges - In-database analytics with SQL extensions – Advanced SQL techniques - MADlib functions.

TOTAL :( L: 45 ) = 45 PERIODS

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- 1. Noreen Burlingame , "The little book on Big Data", New Street publishers, 2012.
- 2. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS Business Series, 2012.
- Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press; 1<sup>st</sup> ed., 2011.
- 4. Jared Dean 2014, Big Data, Data Mining and Machine Learning", Wiley publications.
- 5. Tom White, "Hadoop, The definitive guide", O'Reilly Media, 2010
- 6. http://www.johndcook.com/R\_language\_for\_programmers.html.
- 7. http://bigdatauniversity.com/.
- 8. http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction.\_



- 1. Selim G. Akl, "The Design and Analysis of Parallel Algorithms", Prentice Hall, New Jersey, 1989.
- 2. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, 2003.
- 3. Justin R. Smith, "The Design and Analysis of Parallel Algorithms", Oxford University Press, USA , 1993.
- 4. Joseph JaJa, "Introduction to Parallel Algorithms", Addison-Wesley, 1992.

UNIT II SORTING AND SEARCHING (9) Merging on the EREW and CREW Models -Fast Merging on EREW -Sorting Networks -Sorting on a Linear Array -Sorting on CRCW, CREW, EREW Models - Searching a Sorted Sequence - Searching a Random Sequence. (9)

Relation between PRAM Models -SIMD Algorithms -MIMD Algorithms -Selection -Desirable Properties for Parallel

# UNIT III ALGEBRAIC PROBLEMS

UNIT I INTRODUCTION

Generating Permutations and Combinations in Parallel -Matrix Transpositions -Matrix by Matrix Multiplications -Matrix by Vector multiplication.

# UNIT IV GRAPH THEORY AND COMPUTATIONAL GEOMETRY PROBLEMS

Algorithms -Parallel Algorithm for Selection –Analysis of Parallel Algorithms.

Connectivity Matrix - Connected Components - All Pairs Shortest Paths - Minimum Spanning Trees - Point Inclusion -Intersection, Proximity and Construction Problems -Sequential Tree Traversal -Basic Design Principles -Algorithm -Analysis.

# UNIT V DECISION AND OPTIMIZATION PROBLEMS

Computing Prefix Sums - Applications - Job Sequencing with Deadlines - Knapsack Problem-The Bit Complexity of Parallel Computations.

# TOTAL :( L: 45 ) = 45 PERIODS

(9) Introduction to Parallel Algorithms -Models of Parallel Computation -Sorting on an EREW-SIMD PRAM Computer -

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# **17CPX08 PARALLEL ALGORITHMS**

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| Course Objectives |  | Course Objectives Course Outcomes |   |                           |  |
|-------------------|--|-----------------------------------|---|---------------------------|--|
| 1.0               | To understand the need for parallel algorithms                                       | 1.1                               | The students will be able to discuss the classification of parallel architectures and identify suitable programming models  | 1,3,7,9,10                |  |
| 2.0               | To expose the students to different models of parallel computation                   | 2.1                               | The students will be able to perform sorting on CRCW, CREW, EREW Models   | 1,4,5,6,10                |  |
| 3.0               | To expose the students to parallel sorting and searching algorithms                  | 3.1                               | Search a sorted as well as random sequence  | 2,3,4,5,6,7,8<br>,9,11,12 |  |
| 4.0               | To understand the application of the concepts studied to different types of problems | 4.1                               | The students will be able to develop and<br>analyze algorithms for different applications<br>like matrix multiplication, shortest path, job<br>sequencing and the knapsack problem. | 1,3,4,6,9, 1(             |  |
| 5.0               | To analyze parallel algorithms   | 5.1                               | The students will be able to find the complexity of the parallel algorithms.  | 1,3,4,6,9, 10             |  |

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| PRER              | EQUISITE: NIL   |     |   |                                |                        |                  |                |
| COUR              | SE OBJECTIVES AND OUTCOMES:   |     |   |                                |                        |                  |                |
| Course Objectives |   |     | Course Outcomes   |                                |                        |                  |                |
| 1.0               | To understand the optimization<br>techniques used in compiler design.1.1The students will be able to design<br>Compilers for a programming language.  |     |   |                                | 1,2,3,7,9,<br>10,11,12 |                  |                |
| 2.0               | To be aware of the various computer<br>architectures that support parallelism.2.1The students will be able to map the<br>process of Compilation for a programming<br>paradigm and design compiler for the same. |     |   | the the ming ame.              | 1,2,3<br>10,11         | 3,9,<br>I,12     |                |
| 3.0               | To become familiar with the theoretical background needed for code optimization.  | 3.1 | The students will be able to<br>Implementation leads to a m<br>implementation of the dataflow a   | o data<br>ore eff<br>nalysis.  | icient                 | 1,2,3,4<br>10,11 | 1,7,9,<br>1,12 |
| 4.0               | To understand the techniques used<br>for identifying parallelism in a<br>sequential program.  | 4.1 | The students will be able<br>different optimization technique<br>the overall objective of program | to con<br>s to ac<br>efficienc | nbine<br>hieve<br>cy.  | 1,2,3,4<br>10,11 | 1,7,9,<br>1,12 |
| 5.0               | To learn the various optimization algorithms  | 5.1 | The students will be able to exp procedural analysis techniques.                                  | lore on                        | inter                  | 1,2,3,<br>10,11  | ,4,9,<br>I,12  |

**17CPX09 COMPILER CONSTRUCTION AND OPTIMIZATION** 

# UNIT I INTRODUCTION

Language Processors - The Structure of a Compiler – The Evolution of Programming Languages The Science of Building a Compiler – Applications of Compiler Technology Programming Language Basics - The Lexical Analyzer Generator -Parser Generator - Overview of Basic Blocks and Flow Graphs - Optimization of Basic Blocks - Principle Sources of Optimization.

## UNIT II INSTRUCTION-LEVEL PARALLELISM

Processor Architectures – Code-Scheduling Constraints – Basic-Block Scheduling – Global Code Scheduling – Software Pipelining.

# UNIT III OPTIMIZING FOR PARALLELISM AND LOCALITY-THEORY

Basic Concepts – Matrix-Multiply: An Example - Iteration Spaces - Affine Array Indexes – Data Reuse Array data dependence Analysis.

# UNIT IV OPTIMIZING FOR PARALLELISM AND LOCALITY – APPLICATION

Finding Synchronization - Free Parallelism – Synchronization between Parallel Loops – Pipelining – Locality Optimizations – Other Uses of Affine Transforms.

# UNIT V INTERPROCEDURAL ANALYSIS

42 | P a g e

Basic Concepts – Need for Interprocedural Analysis – A Logical Representation of Data Flow – A Simple Pointer-Analysis Algorithm – Context Insensitive Interprocedural Analysis - Context Sensitive Pointer-Analysis - Datalog Implementation by Binary Decision Diagrams.

# TOTAL :( L: 45 ) = 45 PERIODS

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- 1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, "Compilers: Principles, Techniques and Tools", 2<sup>nd</sup> ed., Pearson Education,2008.
- 2. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
- 3. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers Elsevier Science, India, Indian Reprint 2003.



| understanding of Adhoc network protocols.                             |     | technology trends for the implementation and deployment of ad                             |
|---|-----|---|
| To comprehend WLAN and IEEE standards                                 | 3.1 | The students will be able to insight in medium access mechanisms in WLAN and IEEE 802.11. |
| To be familiar with the challenges in designing routing and transport | 4.1 | The students will be able to explore on the challenges in designing routing and           |

comprehensive

1.1

2.1

5.1

# UNIT I AD HOC MAC

PREREQUISITE: 17CPA02

1.0

2.0

3.0

4.0

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networks.

COURSE OBJECTIVES AND OUTCOMES:

**Course Objectives** 

principles of Adhoc Networks

develop

To know about the fundamental

а

protocols for wireless Ad-hoc/sensor

To understand current and emerging

trends in Wireless Networks.

Introduction - Issues in Ad-Hoc Wireless Networks, MAC Protocols - Issues, Classifications of MAC protocols, Multi channel MAC & Power control MAC protocol.

area of ad

17CPX10 AD HOC NETWORKS

# UNIT II AD-HOC NETWORK ROUTING & TCP

Issues - Classifications of routing protocols - Hierarchical and Power aware. Multicast routing - Classifications, Tree based, Mesh based- Ad Hoc Transport Layer Issues. TCP Over Ad Hoc -Feedback based, TCP with explicit link, TCP-Bus, Ad Hoc TCP, and Split TCP.

# UNIT III WSN -MAC

Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

## UNIT IV WSN ROUTING, LOCALIZATION & QoS

Issues in WSN routing – OLSR, AODV- Localization – Indoor and Sensor Network Localization. QoS in WSN.

## **UNIT V MESH NETWORKS**

44 | P a g e

Necessity for Mesh Networks - MAC enhancements - IEEE 802.11s Architecture - Opportunistic routing - Self configuration and Auto configuration - Capacity Models - Fairness - Heterogeneous Mesh Networks - Vehicular Mesh Networks.

# TOTAL :( L: 45 ) = 45 PERIODS

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Related

Program outcomes

1,2,3,7,9,

10,11,12

1,2,3,9,

10,11,12

1,2,3,4,7,9,

11,12

1,2,3,4,7,

10,11

1,2,3,9,

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**Course Outcomes** 

unique issues in adhoc

transport protocols

hoc/sensor networks.

The students will be able to describe the

The students will be able to describe current

for

The students will be able to have broad

knowledge on future wireless networks and

awareness of a few new trends within the

wireless

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- 1. C.Siva Ram Murthy and B.Smanoj, "Ad Hoc Wireless Networks Architectures and Protocols", Pearson Education, 2004.
- 2. Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufman Publishers, 2004.
- 3. C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2002.
- 4. Thomas Krag and Sebastin Buettrich, "Wireless Mesh Networking", O"Reilly Publishers, 2007.



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|------|--|-----|---|-----------------|----------------|-------|-------|
|      |  |     |   | 3               | 0              | 0     | 3     |
| PRER | EQUISITE: NIL  |     |   |                 |                |       |       |
| COUR | SE OBJECTIVES AND OUTCOMES:                                  |     |   |                 |                |       |       |
|      |  |     |   |                 |                | Rela  | ted   |
|      | Course Objectives  |     | Course Outcomes   |                 |                | Prog  | ram   |
|      |  |     |   |                 |                | outco | omes  |
| 1.0  | To understand the concepts of                                | 1.1 | The students will be able to i                                | impleme         | ent a          | 1.3.4 | 4.8.  |
|      | machine learning.  |     | neural network for an applica                                 | tion of         | your           | 10.1  | 1.12  |
|      |  |     | choice using an available tool.                               |                 |                | ,.    | .,    |
| 2.0  | To appreciate supervised and unsupervised learning and their | 2.1 | The students will be able to probabilistic discriminative and | iimple<br>genei | ment<br>rative | 1,2,3 | 8,5,7 |
|      | applications.  |     | algorithms for an application of                              | your c          | hoice          |       |       |
|      |  |     | and analyze the results.                                      |                 |                |       |       |
| 3.0  | To understand the theoretical and                            | 3.1 | The students will be able to u                                | se a to         | ool to         | 1,2,4 | ,6,7  |
|      | practical aspects of Probabilistic                           |     | implement typical clustering al                               | gorithm         | s for          |       |       |
|      | Graphical Models.  |     | different types of applications.                              |                 |                |       |       |
| 4.0  | To learn aspects of computational                            | 4.1 | The students will be able                                     | to id           | entify         | 1,7,  | 8,9   |
|      | learning theory.   |     | applications suitable for different                           | ent type        | es of          | , ,   |       |
|      |  |     | machine learning with suitable J                              | ustificati      | ion            |       |       |
| 5.0  | To understand graphical models of                            | 5.1 | Modify existing machine learning                              | g algorit       | thms           | 1.7.  | 8.9   |
| •••  | machine learning algorithms                                  |     | to improve classification efficiend                           | Cy -            |                | -,-,  | -,-   |

**17CPX11 MACHINE LEARNING TECHNIQUES** 

# UNIT I INTRODUCTION

Machine Learning - Machine Learning Foundations –Overview – applications - Types of machine learning - basic concepts in machine learning Examples of Machine Learning -Applications – Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison.

# UNIT II SUPERVISED LEARNING

Linear Models for Classification - Discriminant Functions -Probabilistic Generative Models -Probabilistic Discriminative Models - Bayesian Logistic Regression - Neural Networks -Feed-forward Network Functions - Error Back propagation- Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods - Dual Representations - Radial Basis Function Networks.

## UNIT III UNSUPERVISED LEARNING

Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model selection for latent variable models - high-dimensional spaces -- The Curse of Dimensionality –Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis.

## UNIT IV TREE MODELS

46 | P a g e

Decision trees – Classification Trees - Regression Trees - Clustering Trees - Pruning - Ensemble methods - Bagging - Boosting.

# UNIT V PROBABILISTIC GRAPHICAL MODELS

Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties - FromDistributions to Graphs -Examples -Markov Random Fields - Inference in Graphical Models – Learning –Naive Bayes classifiers-Markov Models – Hidden Markov Models – Inference – Learning- Generalization.

## TOTAL :( L: 45 ) = 45 PERIODS

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- 1. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2006.
- 2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
- 3. Ethem Alpaydin, "Introduction to Machine Learning", Prentice Hall of India, 2005.
- 4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
- 5. Hastie, Tibshirani, Friedman, "The Elements of Statistical Learning", 2nd ed., Springer, 2008.
- 6. Stephen Marsland, "Machine Learning An Algorithmic Perspective", CRC Press, 2009.



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# UNIT I FUNDAMENTALS OF IMAGE PROCESSING

Introduction - Image Processing System - Steps In Image Processing Systems -Sampling And Quantization - Color Fundamentals And Models, File Formats. Image Transforms: DFT, FFT, DCT, Walsh, Hadamard, Haar, Slant, KL and Radon Transforms.

## UNIT II IMAGE ENHANCEMENT AND RESTORATION

Histogram processing - Fundamentals of Spatial Filtering - Histogram Processing- Smoothing and Sharpening Spatial Filters. Filtering in Frequency Domain: Image Smoothing and Sharpening using Frequency Domain Filters. Noise Models - Inverse Filtering - Geometric Spatial transformation - image rest ration technique.

# UNIT III IMAGE SEGMENTATION AND FEATURE ANALYSIS

Detection of Isolated Points - Line Detection - Edge Models - Edge Linking and Boundary Detection - Thresholding - Region based Segmentation - The use of motion in Segmentation - Feature analysis and Extraction.

# UNIT IV MULTI RESOLUTION ANALYSIS AND COMPRESSIONS

Multi Resolution processing: Image pyramids - Sub band Coding - Multiresolution Expansions - Wavelet Transform in one dimension and two dimensions - Wavelet Packets. Image Compression: Fundamentals - Models - Elements of Information Theory - Lossy compression - Compression Standards - JPEG/MPEG.

## UNIT V APPLICATIONS OF IMAGE PROCESSING

Represetation and Description, Image Recognition - Image Understanding - Image Classification - Video Motion Analysis – Image Fusion – Image Steganography – Color Image Processing.

and segmentation To get exposed to the applications of The students will be able to apply all image 5.1 Image Processing enhancement techniques.

### **17CPX12 DIGITAL IMAGE PROCESSING AND APPLICATION** Ρ С L Т 3 0 0 3 PREREQUISITE: NIL COURSE OBJECTIVES AND OUTCOMES: Related **Course Objectives Course Outcomes** Program outcomes To apply principles and techniques of The students will be able to apply principles 1.1 1.0 1,2,3,4,6,8, and techniques of digital image processing digital image processing in 10,11 applications related to digital imaging in applications related to digital imaging system design and analysis. system design and analysis. To analyze and implement image The students will be able to acquire the 2.1 2.0 1,2,3,5,7,9, processing algorithms. fundamental concepts of a digital image 10 processing system. The students will be able to analyze and To gain hands-on experience in using 3.0 3.1 1,2,4,6,7,8, software tools for processing digital implement image processing algorithms 11,12 images. To become familiar with image The students will be able to use image 4.1 4.0 1,2,3,5,7,9, compression compression and segmentation Techniques 10 techniques

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- 1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Pearson Education, 3rd ed., 2010.
- 2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt.Ltd., 2011.
- Jayaraman S., Esaki Rajan S., T.Veera Kumar, "Digital Image Processing", Tata McGraw Hill Pvt. Ltd., 2<sup>nd</sup> Reprint, 2010.
- Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Tata McGraw Hill Pvt. Ltd., 3<sup>rd</sup> ed., 2011.
- 5. Bhabatosh Chanda, Dwejesh Dutta Majumder, "Digital Image Processing and analysis", PHI Learning Pvt. Ltd., 2<sup>nd</sup> ed., 2011.
- 6. Malay K.Pakhira, "Digital Image Processing and Pattern Recognition", PHI Learning Pvt. Ltd., 1<sup>st</sup> ed, 2011.
- 7. Annadurai S., Shanmugalakshmi R., "Fundamentals of Digital Image Processing", Pearson Education, 1<sup>st</sup> ed., 2007.



|                   | 17CPX13 SOFTV  | VARE R          | EQUIREMENT ENGINEERING  |   |                             |               |        |
|-------------------|--|-----------------|---|---|-----------------------------|---------------|--------|
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| PRER              | EQUISITE: NIL  |                 |   |   |                             |               |        |
| COUR              | SE OBJECTIVES AND OUTCOMES:  |                 |   |   |                             |               |        |
| Course Objectives |  | Course Outcomes |   |   | Related Program<br>outcomes |               |        |
| 1.0               | To understand the basic concepts of software requirements engineering.                                       | 1.1             | The students will be able to define<br>process for requireme<br>engineering.  | a<br>nt                                 | 1,2,4,5,                    | 7,9,10,       | 11,12  |
| 2.0               | To understand the stakeholders involved in requirements engineering.   | 2.1             | The students will be able to design<br>software engineering syster<br>component, or process to me<br>desired needs within realist<br>constraints such as economi<br>environmental, social, politica<br>ethical, health and safet<br>manufacturing and sustainability. | a<br>n,<br>et<br>tic<br>c,<br>al,<br>y, | 2,3,4,5,                    | 7,8,9,1(<br>2 | 0,11,1 |
| 3.0               | To be able to recognize requirements<br>of each type, a prerequisite for<br>effective documentation writing. | 3.1             | The students will be able<br>understand the professional ar<br>ethical responsibilities of a softwa<br>engineer.  | to<br>nd<br>re                          | 2,5                         | ,8,11,1       | 2      |

# UNIT I INTRODUCTION

Introduction – Requirements engineering – categories of requirements –requirements in software life cycle-agile development process and requirement engineering- identifying stake holders-arte-fact driven elicitation techniques-stake holder driven elicitation technique-risk analysis-requirement prioritization.

# UNIT II REQUIREMENT SPECIFICATION AND DOCUMENTATION

Diagrammatic notations: system scope-conceptual structures-activities and data-instruction flow-interaction scenarios-system behavior-stimuli and behavior-formal specification

# UNIT III QUALITY ASSURANCE AND EVOLUTION

Requirements inspection and review-validation by specification animation-verification through formal checksevolution: time space dimension-change anticipation-traceability management- control management-runtime monitoring.

# UNIT IV BUILDING SYSTEM MODELS

50 | P a g e

Modeling system objectives with goal diagrams-building goal models-risk analysis on goal models-modeling conceptual objects with class diagrams.

# UNIT V REASONING ABOUT SYSTEM MODELS

Semiformal reasoning-formal specification of system models-formal reasoning for specification construction and analysis.

# TOTAL :( L: 45 ) = 45 PERIODS

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- 1. Axel van Lamsweerde, "Requirements Engineering", Wiley, 2009.
- 2. Gerald Kotonya, Ian Sommerville, "Requirements Engineering: Processes and Techniques", John Wiley and Sons, 1998.
- 3. Dean Leffingwell and Don Widrig, "Managing Software Requirements: A Use Case Approach", 2<sup>nd</sup> ed., Addison-Wesley, 2003.
- 4. SEI Report, "Quality Attributes Workshop", http://www.sei.cmu.edu/library/abstracts/reports/03tr016.cfm, 2003.
- 5. J Nielsen, "Usability Engineering", Academic Press, 1993.



## **17CPX14 WIRELESS SENSOR NETWORKS**

### PREREQUISITE: 17CPA02 COURSE OB JECTIVES AND OUTCOMES.

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|-------------------|--|-----|--|--------------------------------|--|--|--|--|--|
| Course Objectives |  |     | Course Outcomes  | Related<br>Program<br>outcomes |  |  |  |  |  |
| 1.0               | To learn the basics of wireless sensor network.                | 1.1 | The students will be able to explain about<br>the various applications, Constraints and<br>Challenges of wireless sensor networks. | 1,2,4,5,7,9,<br>10,11,12       |  |  |  |  |  |
| 2.0               | To enhance the working knowledge on Localization and Tracking. | 2.1 | The students will be able to work on Localization and Tracking.  | 1,2,3,5,6,7,9,<br>10,11,12     |  |  |  |  |  |
| 3.0               | To gain knowledge about routing protocols.                     | 3.1 | The students will be able to summarize IEEE standards and routing protocols.   | 1,2,5,6,7,9,<br>10,11,12       |  |  |  |  |  |
| 4.0               | To learn Sensor Network Databases.                             | 4.1 | The students will be able to develop applications on wireless motes, smart phones and other embedded platforms.                    | 1,2,3,4,7,8,<br>9,10,11,12     |  |  |  |  |  |
| 5.0               | To know recent Tools and Techniques for real time application. | 5.1 | The students will be able to identify suitable tools and techniques for sensor network applications                                | 1,2,3,4,5,<br>9,10,11,12       |  |  |  |  |  |

## UNIT I INTRODUCTION TO SENSOR NETWORKS

Background of Sensor Network Technology and Their Applications - Constraints and Challenges - Collaborative Processing – Basic Sensor Network Architectural Elements – Basic Wireless Sensor Technology – Hardware Components - Operating System and Execution Environment - Comparison of Wireless Sensor Networks with Mobile Adhoc Networks.

# UNIT II LOCALIZATION AND TRACKING

Tracking Scenario – Problem Formulation – Distributed Representation and Interface of States – Tracking Multiple Objects - Sensor Models - Performance Comparison and Metrics.

# UNIT III NETWORK STANDARDS AND ROUTING PROTOCOLS

The SMAC Protocol – IEEE 802.15.4 Standard and ZigBee – Routing challenges and design issues in Wireless Sensor Network – Energy Efficient Unicast Routing – Geographical Routing.

# UNIT IV SENSOR NETWORK DATA BASES

52 | P a g e

Sensor Data base challenges–Querying the Physical Environment – Query Interfaces – High level Data Base Organization - Network aggregation - TinyDB Query Processing - Data Centric Storage - Data indices and Range Queries -Distributed Hierarchical Aggregation.

# UNIT V SENSOR NETWORK PLATFORMS AND TOOLS

Sensor Node Hardware - Berkeley Motes - Programming Challenges- Node-level Software Platforms - Node-level Simulators - State-centric Programming - Emerging Applications of Wireless Sensor Networks - Case study using SENSE.

## TOTAL :( L: 45 ) = 45 PERIODS

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- 1. F. Zhao and L. Guibas, "Wireless Sensor Network: Information Processing Approach", Elsevier, 2012.
- 2. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", Elsevier, 2007.
- 3. KazemSohraby, Daniel Minoli, & TaiebZnati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley, 2007.
- 4. E. H. Callaway, Jr. E. H. Callaway, "Wireless Sensor Networks Architecture and Protocols", CRC Press, 2004.



## 17CPX15 VIRTUALIZATION TECHNIQUES

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## PREREQUISITE: NIL

### COURSE OBJECTIVES AND OUTCOMES:

|     | Course Objectives   |     | Course Outcomes  | Related<br>Program<br>outcomes |
|-----|---|-----|--|--------------------------------|
| 1.0 | To learn basics of virtualization.  | 1.1 | The students will be able to understand the main concepts, key technologies, strengths, and limitations of virtualization.       | 1,2,3,8,9,11,12                |
| 2.0 | To study how to allocate memory in different environment.                 | 2.1 | The students will be able to develop the infrastructure of interfacing, including public cloud, private cloud, and hybrid cloud. | 1,2,3,4,5,8, 10,11             |
| 3.0 | To know the virtual infrastructure management.                            | 3.1 | The students will be able to manage capabilities for planning, deploying, managing, and optimizing virtual infrastructure.       | 1,3,4,8,10,11,12               |
| 4.0 | To learn how effectively migrate a running production in virtual machine. | 4.1 | The students will be able to solve the appropriate machine learning solutions and then recommended.                              | 1,2,3,5,7,8,10                 |
| 5.0 | To get knowledge about virtual server                                     | 5.1 | The students will be able to apply the Microsoft Virtual Server Environment in virtual machine.                                  | 1,2,3,4,6,7, 8,10              |

## UNIT I OVERVIEW OF VIRTUALIZATION

Basics of Virtualization – Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-leveler Operating Virtualization – Application Virtualization–Virtualization Advantages –VirtualMachine:CPUvirtualization – Privileged instructions handling –Hypervisor –Para virtualization– Hardware Assisted virtualization – Booting up – Time keeping – CPU scheduling –Commercial examples.

## UNIT II MEMORY SERVER CONSOLIDATION

Hardware Virtualization – Virtual Hardware Overview – Sever Virtualization – Physical and Logical Partitioning – Types of Server Virtualization – Business cases for Sever Virtualization – Uses of Virtual server Consolidation –Partitioning – Reclamation – Ballooning – Memory sharing – OS level virtualization –VM Ware –Red Hat Enterprise Virtualization.

## UNIT III NETWORK VIRTUALIZATION

Design of Scalable Enterprise Networks – Virtualizing the Campus WAN Design – WAN Architecture – WAN Virtualization – Virtual Enterprise Transport Virtualization–VLANsand Scalability – Theory Network Device Virtualization Layer 2 – VLANs Layer3 VRFInstances Layer 2 – VFIs Virtual Firewall Contexts Network Device Virtualization – Data-PathVirtualization Layer 2: 802.1q – Trunking Generic Routing Encapsulation –IPsecL2TPv3 Label Switched Paths – Control-Plane Virtualization–Routing Protocols– VRF –Aware Routing Multi–Topology Routing.

## UNIT IV I/O VIRTUALIZING STORAGE

54 | P a g e

SCSI– Speaking SCSI– Using SCSI buses – Fiber Channel – Fiber Channel Cables –Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical StorageModel – SNIA Shared Storage Model – Host based Architecture – Storage basedarchitecture – Network basedArchitecture – Fault tolerance to SAN – PerformingBackups – Virtual tape libraries.

## UNIT V VIRTUALIZEDMACHINE COMPUTING

Xen Virtual machine monitors– Xen API – VMware – VMware products – VMwareFeatures – Microsoft Virtual Server – Features of Microsoft Virtual Server–Virtual machine based distributed computing, elastic cloud computing, clustering, cold and hot migration – Commercial examples – Challenges and future trends.

## TOTAL :( L: 45 ) = 45 PERIODS

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- 1. William von Hagen, "Professional Xen Virtualization", Wrox Publications, January, 2008.
- 2. Jim Smith, "Virtual Machines: Versatile Platforms for Systems and Processes", Auerbach Publications, 2006.
- 3. Chris Wolf, Erick M. Halter, "Virtual Infrastructure and Virtualization: From the Desktop to the Enterprise", Apress Publications, 2005.
- 4. James E. Smith, Ravi Nair," Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann Publications, 2005.
- 5. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006



|     |                                      |   |                             |                                  | L        |        | Р        | C      |  |
|-----|--------------------------------------|---|-----------------------------|----------------------------------|----------|--------|----------|--------|--|
|     |                                      |   |                             |                                  | 3        | 0      | 0        | 3      |  |
|     | PRER                                 | EQUISITE: NIL                           |                             |                                  |          |        |          |        |  |
|     | COUR                                 | SE OBJECTIVES AND OUTCOMES:             |                             |                                  |          |        |          |        |  |
|     |                                      |   |                             |                                  |          |        | Rela     | ted    |  |
|     |                                      | Course Objectives                       |                             | Course Outcomes                  |          |        | Progr    | am     |  |
|     |                                      |   |                             |                                  |          |        | outcomes |        |  |
|     | 1.0                                  | To learn the key aspects of soft        | 1.1                         | Students will be able to un      | derstan  | d the  | 1.2.3.8  | .9. 11 |  |
|     |                                      | computing.                              |                             | soft computing techniques ar     | nd their | roles  |          |        |  |
|     |                                      |   |                             | in building intelligent Machines | S.       |        |          |        |  |
|     | 2.0                                  | To understand the concepts of Genetic   | 2.1                         | Students will be able to a       | pply ge  | enetic | 1,2,3,4  | 4,5,8, |  |
| 2.0 | algorithm and its applications using |   | algorithms to combinatorial | optimiz                          | zation   | 10,11  | 1,12     |        |  |
|     |                                      | image processing.                       |                             | problems.                        |          |        |          |        |  |
|     | 3.0                                  | To be familiar with neural networks and | 3.1                         | Students will be able to         | differe  | ntiate | 1.2.3.4  | .5.6.7 |  |
|     |                                      | generalize its appropriate rules for    | -                           | supervised and unsupervis        | ed lea   | arning | .9.10.1  | 11.12  |  |
|     |                                      | inference systems.                      |                             | neural networks.                 |          |        | ,0,10,1  | ,      |  |
|     | 40                                   | To learn the ideas of fuzzy sets, fuzzy | 41                          | Students will be able to solv    | e fuzzy  | logic  | 1234     | 678    |  |
|     | 4.0                                  | logic and its operations                |                             | to handle uncertainty            | engine   | ering  | 0 10 4   | 11 12  |  |
|     |                                      |   |                             | problems.                        | <u> </u> | Ũ      | ,9,10,1  | 11,12  |  |
|     | 5.0                                  | To gain insight into Neuro-Fuzzy        | 5.1                         | Students will be able to apply   | neuro    | fuzzy  | 1,2,3    | ,4,9,  |  |
|     |                                      | modeling and control.                   |                             | modeling to pattern classi       | fication | and    | 10.1     | 1 1 2  |  |
|     |                                      | -                                       |                             | regression problems              |          |        | 10,1     | 1,12   |  |

17CPX16 SOFT COMPUTING

## UNIT I INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS

Evolution of Computing – Soft Computing Constituents – From Conventional AI to Computational Intelligence – Machine Learning basics.

# UNIT II GENETIC ALGORITHMS

Introduction to Genetic Algorithms (GA)- Applications of GA in Machine Learning - GA based Image processing.

## UNIT III NEURAL NETWORKS

Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks – Supervised Learning Neural Networks–Radial Basis Function Networks – Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance architectures – Case Study: River Flow Forecasting.

## UNIT IV FUZZY LOGIC

56 | P a g e

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Logic – Fuzzy Expert Systems – Fuzzy Decision Making.

## UNIT V NEURO-FUZZY MODELING

AdaptiveNeuro-FuzzyInferenceSystems – CoactiveNeuro-FuzzyModeling–Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control.

TOTAL :( L: 45 ) = 45 PERIODS

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- 1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2008.
- 2. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 2003.
- 3. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, 4<sup>th</sup> Impression, 2009.
- 4. S.N.Sivanandam, S.Sumathi and S.N.Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer, 2007.
- 5. S.N.Sivanandam, S.N.Deepa, "Introduction to Genetic Algorithms", Springer, 2007.
- 6. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.
- 7. Sandhya Samarasinghe, "Neural Networks for Applied Sciences and Engineering", Auerbach Publications, 2006.



|                                 |  |     |   | L               | Т     | Р                      | С                              |  |  |
|---------------------------------|--|-----|---|-----------------|-------|------------------------|--------------------------------|--|--|
|                                 |  |     |   | 3               | 0     | 0                      | 3                              |  |  |
| PREREQUISITE: 17CPA02           |  |     |   |                 |       |                        |                                |  |  |
| COURSE OBJECTIVES AND OUTCOMES: |  |     |   |                 |       |                        |                                |  |  |
| Course Objectives               |  |     | Course Outcomes   |                 |       |                        | Related<br>Program<br>outcomes |  |  |
| 1.0                             | To understand system requirements for mobile applications.             | 1.1 | The students will be able to describe the requirements for mobile applications.                   |                 |       | 1,2,3,4,8,<br>10,11,12 |                                |  |  |
| 2.0                             | To learn suitable design using specific mobile development frameworks. | 2.1 | The students will be able to explain the challenges in mobile application design and development. |                 |       | 1,3,8,1                | 0,11                           |  |  |
| 3.0                             | To create mobile application design.                                   | 3.1 | The students will be able to de<br>applications for specific require                              | esign ments.    | obile | 1,3,4,<br>10,11        | ,5,8,<br>I,12                  |  |  |
| 4.0                             | To understand the design using specific mobile development frameworks. | 4.1 | The students will be able to develop the design using Android SDK and iOS SDK.                    |                 |       |                        | ,6,78,<br>I,12                 |  |  |
| 5.0                             | To know the latest technologies available in mobile application.       | 5.1 | The students will be able to de<br>applications in Android and iPhe                               | eploy m<br>one. | obile | 1,3,4,8<br>1,1         | 9,10,1<br>2                    |  |  |

17CPX17 MOBILE APPLICATION DEVELOPMENT

# UNIT I INTRODUCTION

Introduction to mobile applications - Importance of mobile strategies - Cost of development - Mobile myths - Market and business drivers for mobile applications - Mobile web presencee - Mobile applications - Benefits of a mobile app.

# UNIT II BASIC DESIGN

Introduction- Mobile user interface design-Understanding mobile application users-Understanding mobile information design - Understanding mobile platforms - Using the tools of mobile interface design.

# UNIT III ADVANCED DESIGN

Choosing a mobile web option - Adaptive mobile websites - Dedicated mobile websites - Mobile web apps with HTML5 – Design patterns for mobile applications – Advanced web service techniques for mobile devices.

# UNIT IV DEVELOPMENT ENVIRONMENT

Android development practices - Android fundamentals - Android SDK - Common interactions- Offline storage iOSSDK- Debugging iOS apps - Objective -C basics - iOS features.

# UNIT V TECHNOLOGY

58 | P a g e

Using google maps - GPS-Wi-Fi and WiMAX- Integration with social media applications- Foldable displays -Centralized storage - Mobile commerce.

# TOTAL :( L: 45 ) = 45 PERIODS

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- 1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
- 2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012.
- 3. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012.
- 4. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
- 5. http://developer.android.com/develop/index.html.



|                                       | •  |                                |   | outcomes  |
|---------------------------------------|--|--------------------------------|---|---|
| 1.0                                   | To learn basics of network flow problems.  | 1.1                            | The students will be able to identify the network optimization problems and algorithms for solving them.                                  | 1,2,3,5,7,8,<br>10                                    |
| 2.0                                   | To be familiar with various algorithms.  | 2.1                            | The students will be able to develop algorithmic thinking skills.   | 1,2,3,5,7,8,<br>10                                    |
| 3.0                                   | To study basics of nonlinear network optimization.   | 3.1                            | The students will be able to categorize nonlinear network optimization problems.  | 1,2,3,5,7,8,9<br>,10                                  |
| 4.0                                   | To understand the issues in the design of networks.  | 4.1                            | The students will be able to solve the network flow problems.   | 1,2,3,5,7,8,<br>10                                    |
| 5.0                                   | To know the techniques used for network problems with integer constraints.   | 5.1                            | The students will be able to select suitable techniques used for network problems.  | 1,2,3,5,6,7,8<br>, 10                                 |
| UNIT I                                | INTRODUCTION AND SHORTEST FLO  | OW PRC                         | OBLEMS  | (9)   |
| Introdu<br>Proble<br>Metho<br>Origin/ | iction – Graphs and Flows– Network F<br>ms – Problem Formulation and Applica<br>ds – Label Correcting Methods– Single<br>Multiple Destination Methods. | Flow Mo<br>tions –<br>e Origin | dels– Examples – Network Flow Algorithms -<br>A Generic Shortest Path Algorithm– Label Se<br>/Single Destination Methods – Auction Algori | -Shortest Path<br>etting (Dijkstra)<br>thms– Multiple |
| UNITI                                 | I MAX-FLOW PROBLEM AND MIN-COS   | ST FLOV                        | N PROBLEM   | (9)   |
| The M<br>Min-Co                       | lax-Flow and Min-Cut Problems–The Fo<br>ost Flow Problem– Transformations and E  | ord-Fulke<br>quivaler          | erson Algorithm– Price-Based Augmenting Path<br>nces– Duality.  | 1 Algorithms-   |

**17CPX18 NETWORK OPTIMIZATION TECHNIQUES** 

# UNIT III NONLINEAR NETWORK OPTIMIZATION

PREREQUISITE: NIL

COURSE OBJECTIVES AND OUTCOMES:

**Course Objectives** 

Convex and Separable Problems- Problems with Side Constraints- Multicommodity Flow Problems- Integer Constraints- Networks with Gains- Optimality Conditions- Duality- Algorithms and Approximations.

## UNIT IV CONVEX SEPARABLE NETWORK PROBLEMS

ConvexFunctions of a Single Variable- Optimality Conditions- Duality- Dual Function Differentiability- Algorithms for Differentiable Dual Problems- Auction Algorithms- Monotropic Programming.

## UNIT V NETWORK PROBLEMS WITH INTEGER CONSTRAINTS

Formulation of Integer-Constrained Problems- Branch-and-Bound- Lagrangian Relaxation- Local Search Methods-Rollout Algorithms.

TOTAL :( L: 45 ) = 45 PERIODS

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Related

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**Course Outcomes** 

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- 1. Dimitri P. Bertsekas, "Network Optimization: Continuous and Discrete Models", Athena Scientific, 1998.
- 2. Ravindra K. Ahuja, Thomas L. Magnanti and James B. Orlin, "Network Flows: Theory, Algorithms, and Applications", Prentice Hall, 1993.
- 3. Teresa C. Mann-Rubinson and KornelTerplan, "Network Design, Management and Technical Perspective", CRC Press, 1999.
- 4. J.C.Pant, "Introduction to Optimization", Jain Brothers, 2008.
- 5. H.A.Taha, "Operations Research", Pearson Education, 2007.



|                   |   |     |  | 3                                | 0                       | 0                      | 3                   |
|-------------------|---|-----|--|----------------------------------|-------------------------|------------------------|---------------------|
| PRER              | EQUISITE: NIL   |     |  |                                  |                         |                        |                     |
| COUR              | SE OBJECTIVES AND OUTCOMES:   |     |  |                                  |                         |                        |                     |
| Course Objectives |   |     | Course Outcomes  |                                  |                         | Rela<br>Progr<br>outco | ited<br>ram<br>omes |
| 1.0               | To obtain knowledge about the pattern classifier.                             | 1.1 | The students will be able to ex<br>the pattern recognition problems                                | xplain a                         | about                   | 1,2,5<br>10,1          | 5,7,8,<br>1,12      |
| 2.0               | To know about classification problems.  | 2.1 | The students will be able<br>appropriate clustering technique<br>problems.                         | to<br>es for va                  | build<br>arious         | 1,2,3,4<br>2           | 4,11,1<br><u>2</u>  |
| 3.0               | To gain knowledge on various<br>structural pattern recognition<br>techniques. | 3.1 | The students will be able to gai<br>the principles and common<br>grammars for structural pattern r | n insigh<br>nly<br>ecogniti      | it into<br>used<br>ion. | 1,2,3                  | 8,4,7               |
| 4.0               | To perceive knowledge on basic feature extraction techniques.                 | 4.1 | The students will be able to an<br>feature extraction and subs<br>methods for various real world a | nalyze a<br>et sele<br>pplicatio | about<br>ection<br>ons. | 1,2,4,6<br>2           | 6,11,1<br>2         |
| 5.0               | To learn neural networks and fuzzy  | 5.1 | The students will be able to app   | ly the ne                        | eural                   | 1,2,4                  | ,5,9,               |

**17CPX19 PATTERN RECOGNITION** 

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## **UNIT I PATTERN CLASSIFIER**

logic.

Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation - Maximum likelihood estimation - Bayesian parameter estimation - Perception algorithm - LMSE algorithm - Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

network concepts in real world applications.

## UNIT II UNSUPERVISED CLASSIFICATION

Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm - Hierarchical clustering procedures – Graph theoretic approach to pattern clustering – Validity of clustering solutions.

## UNIT III STRUCTURAL PATTERN RECOGNITION

Elements of formal grammars - String generation as pattern description - Recognition of syntactic description -Parsing – Stochastic grammars and applications – Graph based structural representation.

## UNIT IV FEATURE EXTRACTION AND SELECTION

Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation -Binary feature selection.

## UNIT V RECENT ADVANCES

62 | P a g e

Neural network structures for Pattern Recognition - Neural network based Pattern associators - Unsupervised learning in neural Pattern Recognition - Self-organizing networks - Fuzzy logic - Fuzzy pattern classifiers - Pattern classification using Genetic Algorithms.Case study: Web Applications- Medical Applications.

## TOTAL :( L: 45 ) = 45 PERIODS

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- 1. Robert J.Schalkoff, "Pattern Recognition Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., New York, 2007.
- 2. Morton Nadier and Eric Smith P, "Pattern Recognition Engineering", John Wiley & Sons, New York, 1993.
- 3. Tou and Gonzales, "Pattern Recognition Principles", Wesley Publication Company, London, 2006.
- 4. Duda R.O., and HarP.E., "Pattern Classification and Scene Analysis", Wiley, NewYork, 2001.



|      |   |     |                                    | L          |        | Р                 | C       |  |
|------|---|-----|------------------------------------|------------|--------|-------------------|---------|--|
|      |   |     |                                    | 3          | 0      | 0                 | 3       |  |
| PRER | REQUISITE: NIL                          |     |                                    |            |        |                   |         |  |
| COUF | RSE OBJECTIVES AND OUTCOMES:            | •   |                                    |            |        |                   |         |  |
|      |   |     |                                    |            |        | Rela              | ted     |  |
|      | Course Objectives                       |     | Course Outcomes                    |            |        |                   | Program |  |
|      |   |     |                                    |            |        | outco             | omes    |  |
| 1.0  | To understand the basic knowledge       | 1.1 | The students will be able to exp   | olain diff | erent  | 1,2,3,            | 5, 7,   |  |
|      | about evolutionary computation.         |     | historical branches of             | evolutio   | onary  | 10,1 <sup>,</sup> | 1,12    |  |
|      |   |     | computation.                       |            |        |                   |         |  |
| 2.0  | To learn various evolutionary           | 2.1 | hasia proportion of                | aescribe   | e the  | 1,2,3,            | 5, 7,   |  |
|      | computation methods and selection       |     | computation                        | evolutio   | Jilaiy | 10,1 <sup>-</sup> | 1,12    |  |
|      | operators.                              |     |                                    |            |        |                   |         |  |
| 3.0  | To know a variety of evolutionary       | 3.1 | The students will be able to i     | impleme    | enta   | 1,2,3             | ,4,5,   |  |
|      | approaches for problem solving.         |     | problem solving.                   | roaches    | for    | 7,8,10,           | 11,12   |  |
| 4.0  | To learn different optimization         | 4.1 | The students will be able to gair  | n experi   | ence   | 1,2,3,4           | 4,5,6,  |  |
|      | algorithms used for evolutionary-       |     | in applying various optimization   | algorithr  | ns.    | 7,8,1             | 0.11    |  |
|      | computation.                            |     |                                    |            |        |                   |         |  |
| 5.0  | To understand various feasible and      | 5.1 | The students will be able to       | o apply    | the    | 1,2,3             | ,4,5,   |  |
|      | optimal solutions for specific problem. |     | methods of optimization in real li | fe situat  | tion.  | 6.7.8.1           | 0.11.   |  |
|      |   |     |                                    |            |        | 1:<br>1:          | ,,<br>2 |  |

17CPX20 EVOLUTIONARY COMPUTING

# UNIT I INTRODUCTION

Introduction to evolutionary computing Components of Evolutionary Algorithms – Introduction to different historical branches of Evolutionary Computation– Genetic Algorithms– Evolutionary Programming– Evolutionary strategies– Genetic Programming– A simple evolutionary algorithm.

# UNIT II VARIANTS OF EVOLUTIONARY COMPUTATION

Evolutionary Algorithmvs traditional methods – Representation – Mutation – Recombination – Population models – Parent selection – Survivor selection.

# UNIT III EVOLUTIONARY TECHNIQUES

Simulated annealing –Memetic algorithms – Local search – Constraint handling – Common techniques – Penalty methods - repair methods.

# UNIT IV EVOLUTIONARY OPTIMIZATION

Ant Colony Optimization (ACO) – Real to artificial ants – ACO algorithm – Convergence proofs – Particle Swarm Optimization (PSO) – Principles of bird flocking and fish schooling – PSO algorithm – Variants of PSO – Application: TSP.

## UNIT V OPTIMIZATION METHODS

64 | P a g e

Introduction – Combinatorial optimization – Constrained optimization – Multi –Objective evolutionary algorithms. **TOTAL** :( L: 45 ) = 45 PERIODS

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- 1. Eiben A E and Smith J E, "Introduction to Evolutionary Computing", Springer, New York, 2008.
- 2. Dan simon ,"Evolutionary Optimization Algorithms ",John wiley& sons,Canada,2013
- 3. Frank Neumann and Carsten Witt, "Bio-inspired Computation in Combinatorial Optimization", Springer, New York, 2010.
- 4. Marco Dorigo and Thomas Stutzle, "Ant Colony Optimization", Prentice Hall, New Delhi, 2005.
- 5. Jun Sun, Choi-Hong Lai and Xiao-Jun Wu, "Particle Swarm Optimization: Classical and Quantum Perspectives", Taylor and Francis, USA, 2012.
- Carlos A Coello, Gary B Lamont and David A Van Veldhuizen, "Evolutionary Algorithms for Solving Multi-Objective Problems", Springer, New York, 2007.



| 2.0               | To know about different framework used in semantic web.   | 2.1                  | The students will be able to outline for semantic syntax and schema.                           | 1,2,3,5,7,8,<br>10,11,12        |
|-------------------|---|----------------------|--|---------------------------------|
| 3.0               | To learn the methodologies of ontology.   | 3.1                  | The students will be able to design ontology using Web Ontology Language (OWL).                | 1,2,3,5,7,8,9<br>, 10,11        |
| 4.0               | To know about ontology management<br>and tools used for Ontology<br>annotation.                   | 4.1                  | The students will be able to differentiate monotonic and non-monotonic rules.                  | 1,2,3,5,7,8,<br>10,11           |
| 5.0               | To comprehend the role of semantics in web services.  | 5.1                  | The students will be able to apply Semantic web technology to real world application           | 1,2,3,5,6,7,8<br>, 10,11,12     |
| UNIT I            | INTRODUCTION  |                      |  | (9)                             |
| History<br>Names  | <ul> <li>V – Semantic web layers – Semantic we spaces – Addressing – Querying – Proces</li> </ul> | b techno<br>ssing XN | ologies – Semantics in semantic web – XML –<br>/L.   | Structuring –                   |
| UNIT I            | I RDF AND QUERYING THE SEMANT   | IC WEE               | 3  | (9)                             |
| RDF c             | lata model – syntax – Adding semantic<br>atic semantics for RDF and RDF schema                    | s – RD<br>– Query    | F schema – RDF and RDF schema in RDF s<br>ring in SPARQL.                                      | schema – An                     |
| UNIT I            | II ONTOLOGY   |                      |  | (9)                             |
| Introdu<br>comple | uction – Ontology movement – OWL – (<br>ex – Ontology engineering – Introduction                  | OWL sp<br>i – Cons   | ecification – OWL elements – OWL constructs<br>structing ontologies – Reusing ontologies – On- | s – Simple and<br>-To-Knowledge |

**17CPX21 SEMANTIC WEB** 

1.1

# UNIT IV LOGIC AND INFERENCE

semantic web architecture.

PREREQUISITE: NIL

semantic web.

1.0

COURSE OBJECTIVES AND OUTCOMES:

**Course Objectives** 

To learn fundamental concepts of

Logic – Description logics – Rules – Monotonic rules – syntax – semantics and examples – Non-monotonic rules – Motivation – syntax – Examples – Rule markup in XML– Monotonic rules – Non-Monotonic rules.

## UNIT V APPLICATIONS OF SEMANTIC WEB TECHNOLOGIES

Case Study – Horizontal information products at Elsevier – Openacademia – Bibster – Data Integration at Audi – Skill finding at Swiss Life – Think tank portal at Enersearch – e-learning – web services – other scenarios.

TOTAL :( L: 45 ) = 45 PERIODS

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Related

Program outcomes

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**Course Outcomes** 

The students will be able to understand the

fundamental concepts of the semantic web.

С

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- 1. Grigorous Antoniou and Van Hermelen, "A Semantic Web Primer", PHI Learning Private Limited, 2<sup>nd</sup> ed., 2010.
- 2. James Hendler, Henry Lieberman and Wolfgang Wahlster, "Spinning the Semantic Web: Bringing the world wide web to its full potential", The MIT Press, 2005.
- 3. Shelley Powers, "Practical RDF", O'reilly publishers, 2009.
- 4. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph, "Foundations of Semantic Web Technologies", Chapman & Hall/CRC, 2009.



| 1.0  | To learn the basic issues, policy and challenges in the Internet | 1.1     | The students will be able to identify the components of IOT   | 1,3,7,8,9<br>10,11,12               |  |
|--|--|---------|---|-------------------------------------|--|
| 2.0  | To understand the components and the protocols in Internet       | 2.1     | The students will be able to design a portable IOT using appropriate boards                           | 1, <mark>2,3,5,7,9,</mark><br>10,11 |  |
| 3.0  | To build a small low cost embedded system with the internet      | 3.1     | The students will be able to program the sensors and controller as part of IOT                        | 1,2,3,4,5,7,9<br>, 10,11            |  |
| 4.0  | To understand the various modes of communications with internet  | 4.1     | The students will be able to develop<br>schemes for the applications of IOT in real<br>time scenarios | 1,3,4,5,7,9,<br>10,11               |  |
| 5.0  | To learn to manage the resources in the Internet                 | 5.1     | The students will be able to establish the communication to the cloud through Wi-Fi / Bluetooth       | 1,2,3,4,5,7,8<br>,9, 10,11,12       |  |
| (9) UNIT I INTRODUCTION (9) Definition – phases – Foundations – Policy– Challenges and Issues - identification - security – privacy. Components in internet of things: Control Units – Sensors – Communication modules – Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – RF links – Mobile Internet – Wired Communication. |  |         |   |                                     |  |
|  |  |         |   | (9)                                 |  |
| Basics   | or Sensors and actuators - Examples                              | and WC  | Softing principles of sensors and actuators – C   |                                     |  |
|  |  | natiorm | - Setting up the board - Programming for IOT -  | - Reading from                      |  |
| Sensors - Communication-Connecting microcontroller with mobile devices - communication through Bluetooth and   |  |         |   |                                     |  |
| USB –  | USB – connection with the internet using WiFi / Ethernet         |         |   |                                     |  |

# UNIT III RESOURCE MANAGEMENT IN THE INTERNET OF THINGS

Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture -The Role of Context - Design Guidelines -Software Agents for Object - Data Synchronization- Types of Network Architectures - Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things-Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behavior of Objects.

## UNIT IV BUSINESS MODELS FOR THE INTERNET OF THINGS

The Meaning of DiY in the Network Society- Sensor-actuator Technologies and Middleware as a Basis for a DiY Service Creation Framework - Device Integration - Middleware Technologies Needed for a DiY Internet of Things - Semantic Interoperability as a Requirement for DiY Creation - Ontology- Value Creation in the Internet of Things- Application of Ontology Engineering in the Internet of Things-Semantic Web-Ontology - The Internet of Things in Context of EURIDICE - Business Impact.

## UNIT V FROM THE INTERNET OF THINGS TO THE WEB OF THINGS

Resource-oriented Architecture and Best Practices- Designing RESTful Smart Things - Web-enabling Constrained Devices - The Future Web of Things - Set up cloud environment - send data from microcontroller to cloud - Case study -CAM:cloud Assisted Privacy- Other recent projects.

**PRE REQUISITE :** 

Basic programming skills Basic electronics skills COURSE OBJECTIVES AND OUTCOMES:

**Course Objectives** 

## **17CPX22 INTERNET OF THINGS**

**Course Outcomes** 

### Ρ С L т 3 0 0 3

Related

Program outcomes

(9)

(9)

- 1. Charalampos Doukas, "Building Internet of Things with the Arduino", Create space, April 2012.
- 2. Dieter Uckelmann et.al, "Architecting the Internet of Things", Springer, 2011
- 3. Luigi Atzor et.al, "The Internet of Things: A survey", Journal on Networks, Elsevier Publications, October, 2010
- 4. Huang Lin, Gainesville, Jun Shao, Chi Zhang, Yuguang Fang, "CAM: Cloud-Assisted Privacy Preserving Mobile Health Monitoring", IEEE Transactions on Information Forensics and Security, 2013
- 5. Pengwei Hu; Fangxia Hu, "An optimized strategy for cloud computing architecture", 3<sup>rd</sup> IEEE Transactions on Computer Science and Information Technology (ICCSIT), 2010.



| NS – Inter-cloud Resource Management  |     |
|---|-----|
| AMMING MODEL  | (9) |
| oop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and configuring and running a job – Developing Map Reduce Applications - Design of Hadoop file |     |
| ) Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbu  | S   |
| SECURITY  | (9) |
| e security: network, host and application level – aspects of data security, provider data and its   |     |
| nd access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in vacy issues in the cloud –Cloud Security and Trust Management.                        |     |
| TOTAL :( L: 45 ) = 45 PERIO   | DS  |
|   |     |

The students will be able to Apply the

The students will be able to Identify the

architecture, infrastructure and delivery

The students will be able to Develop

The students will be able to Apply the

security models in the cloud environment

services using Cloud computing

models of cloud computing

concept of virtualization in the cloud

### COURSE OBJECTIVES AND OUTCOMES: **Course Objectives Course Outcomes** To understand the concepts of The students will be able to Employ the 1.1 virtualization and virtual machines concepts of storage virtualization, network virtualization and its management

2.1

3.1

4.1

5.1

17CPX23 - CLOUD COMPUTING TECHNOLOGIES

| UNIT I VIRTUALIZATION |  |
|-----------------------|--|
|-----------------------|--|

cloud computing

cloud computing

**PRE REQUISITE : NIL** 

1.0

2.0

3.0

4.0

5.0

Basics of Virtual Machines - Process Virtual Machines - System Virtual Machines - Emulation - Interpretation -Binary Translation - Taxonomy of Virtual Machines. Virtualization - Management Virtualization - Hardware Maximization - Architectures - Virtualization Management - Storage Virtualization - Network Virtualization (9)

computing

# UNIT II VIRTUALIZATION INFRASTRUCTURE

To gain knowledge on the concept of

virtualization that is fundamental to

To understand the various issues in

To be able to set up a private cloud

To understand the security issues in

the grid and the cloud environment

Comprehensive Analysis - Resource Pool - Testing Environment - Server Virtualization - Virtual Workloads -Provision Virtual Machines - Desktop Virtualization - Application Virtualization - Implementation levels of virtualization - virtualization structure - virtualization of CPU, Memory and I/O devices - virtual clusters and Resource Management – Virtualization for data center automation.

# UNIT III CLOUD PLATFORM ARCHITECTURE

Cloud deployment models: public, private, hybrid, community - Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design - Layered cloud Architectural Development – Virtualization Support and Disaster Recovery – Architectural Design Challenges - Public Cloud Platforms : GAE.AV

# UNIT IV PROGRA

Introduction to Had output parameters, system -Setting up

# UNIT V CLOUD S

Cloud Infrastructure security, Identity an the cloud - Key priv

# 10,11,12 1,2,3,4,5,6,7

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Related

Program outcomes

1.2.3.4.6.7

10,11,12

1,2,3,5,7,

10.11

1,2,3,4,5,6,9

, 10,11

1,3,4,5,7,

,10,11,12

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L

3

С

3

- 1. Danielle Ruest, Nelson Ruest, -Virtualization: A Beginner's Guidell, McGraw-Hill Osborne Media, 2009.
- 2. Jim Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005
- 3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
- 4. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
- 5. Tim Mather, Subra Kumaraswamy, and Shahed Latif ,"Cloud Security and Privacy", O'Reilly Media, Inc., 2009.
- 6. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
- 7. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.



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(9) **UNIT IV NGN ARCHITECTURE** 

procedure. (9) **UNIT III SDMN-LTE INTEGRATION** 

UNIT II 4G and BEYOND (9)

UNIT I INTRODUCTION

management and standards.

(9) Evolution of public mobile services -motivations for IP based services, Wireless IP network architecture -3GPP packet data network architecture. Introduction to next generation networks - Changes, Opportunities and Challenges, Technologies, Networks, and Services, Next Generation Society, future Trends.

NGN

**PRE REQUISITE : NIL** 

1.0

2.0

3.0

4.0

5.0

COURSE OBJECTIVES AND OUTCOMES:

**Course Objectives** 

service advantages of next

generation networks.

of 4G and beyond.

challenges with LTE.

QoS provisioning. To learn about the NGM

To learn the technical, economic and

To learn the evolution of technologies

To learn Software defined Mobile

Network issues and integrating

To explore the NGN framework

catering the services of end user with

B Introduction to LTE-A -Requirements and Challenges, network architectures -EPC, E-UTRAN architecturemobility management, resource management, services, channel -logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access

SDN paradigm and applications, SDN for wireless-challenges, Leveraging SDN for 5G networks-ubiquitous connectivity-mobile cloud-cooperative cellular network-restructuring mobile networks to SDN-SDN/LTE integration benefits.

Evolution towards NGN-Technology requirements, NGN functional architecture- Transport stratum, service stratum, service/ content layer and customer terminal equipment function. NGN entities, Network and Service evolution -fixed, mobile, cable and internet evolution towards NGN.

## UNIT V NGN MANAGEMENT AND STANDARDIZATION

NGN requirements on Management-Customer, third party, Configuration, Accounting, performance, device and information management. Service and control management- End-to-End QoS and security. ITU and GSI-NGN releases, ETSI-NGN concept and releases, NGMN alliance and NGMN.

## **17CPX24 NEXT GENERATION NETWORKS**

1.1

2.1

3.1

4.1

5.1

**Course Outcomes** 

To be able to understand the issues and

To be able to explore the LTE concepts and

To be able to understand the integration of

To be able to understand the functioning of

To be able to understand the NGN

management and standardizations.

challenges of wireless domain in future

generation network design.

technologies.

SDN with LTE.

### Ρ С т 0 0 3

Related

Program outcomes

1,2,3,4,5,6,1

1,12

1,2,3,4,5,10,

,12

1,2,5,6,11,

12

1,2,3,11,12

1.2.3.4.5.6.7

,10,11,12

L

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TOTAL :( L: 45 ) = 45 PERIODS
- 1. Jingming Li Salina, Pascal Salina "Next Generation Networks-perspectives and potentials" Wiley, January 2008.
- Madhusanga Liyanage, Andrei Gurtov, Mika Ylianttila, "Software Defined Mobile Networks beyond LTE Network Architecture", Wiley, June 2015.
- 3. Martin Sauter, "3G,4G and Beyond bringing networks, devices and web together", Wiley, 2nd edition-2013.
- 4. Savo G Glisic," Advanced Wireless Networks- Technology and Business models", Wiley, 3rd edition- 2016.
- 5. Thomas Plavyk, -Next generation Telecommunication Networks, Services and Managementl, Wiley & IEEE Press Publications, 2010.



#### **17CPX25 WEB ENGINEERING**

#### L T 3 0

# T P C 0 0 3

## PRE REQUISITE : NIL

# COURSE OBJECTIVES AND OUTCOMES:

| Course Objectives |  | Course Outcomes  | Related Program<br>Outcomes<br>outcomes |  |  |  |  |  |  |  |
|-------------------|--|--|---|--|--|--|--|--|--|--|
| 1.0               | Understand the characteristics of web applications           | <b>1.1</b> The students will be able to explain the characteristics of web applications. | 1,2,3,4,6,10,11,12                      |  |  |  |  |  |  |  |
| 2.0               | Learn to Model web applications                              | 2.1 The students will be able to Model we applications                                   | <sup>)</sup> 1,2,3,5,6,9,10,11          |  |  |  |  |  |  |  |
| 3.0               | Be aware of Systematic design.                               | <b>3.1</b> The students will be able to Design we applications.                          | <sup>0</sup> 1,2,3,4,10,11              |  |  |  |  |  |  |  |
| 4.0               | Be familiar with the testing techniques for web applications | <b>4.1</b> The students will be able to Test applications                                | 1,2,3,4,5,10,11,12                      |  |  |  |  |  |  |  |
| 5.0               | Learn how to manage a project.                               | <b>5.1</b> The students will be able to promote and manage web application               | s 1,2,3,10,11,6,12                      |  |  |  |  |  |  |  |

## UNIT I INTRODUCTION TO WEB ENGINEERING

Motivation, Categories of Web Applications, Characteristics of Web Applications. Requirements of Engineering in Web Applications- Web Engineering-Components of Web Engineering-Web Engineering Process-Communication-Planning.

#### UNIT II WEB APPLICATION ARCHITECTURES & MODELLING WEB APPLICATIONS

Introduction- Categorizing Architectures- Specifics of Web Application Architectures, Components of a Generic Web Application Architecture- Layered Architectures, 2-Layer Architectures, N-Layer Architectures-Data-aspect Architectures, Database-centric Architectures- Architectures for Web Document Management- Architectures for Multimedia Data- Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Framework-Modeling languages- Analysis Modeling for WebApps-The Content Model-The Interaction Model-Configuration Model.

#### UNIT III WEB APPLICATION DESIGN

Design for WebApps- Goals-Design Process-Interactive Design- Principles and Guidelines-Workflow-Preliminaries-Design Steps- Usability- Issues- Information Design- Information Architecture- structuring- Accessing Information-Navigation Design- Functional Design-WepApp Functionality- Design Process- Functional Architecture- Detailed Functional Design.

## UNIT IV TESTING WEB APPLICATIONS

Introduction-Fundamentals-Test Specifics in Web Engineering-Test Approaches- Conventional Approaches, Agile Approaches- Testing concepts- Testing Process -Test Scheme- Test Methods and Techniques- Link Testing-Browser Testing-Usability Testing- Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, -Content Testing-User Interface testing-Usability Testing-Compatibility Testing-Component Level Testing-Navigation Testing-Configuration testing-Security and Performance Testing- Test Automation.

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## UNIT V PROMOTING WEB APPLICATIONS AND WEB PROJECT MANAGEMENT

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Introduction-challenges in launching the web Application-Promoting Web Application-Content Management-Usage Analysis-Web Project Management-Challenges in Web Project Management-Managing Web Team- Managing the Development Process of a Web Application- Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JS - web sockets.

## TOTAL :( L: 45 ) = 45 PERIODS

#### **REFERENCES:**

- 1. Chris Bates, Web Programming: Building Internet Applicationsl, Third Edition, Wiley India Edition, 2007.
- 2. Gerti Kappel, Birgit Proll, –Web Engineeringl, John Wiley and Sons Ltd, 2006.
- 3. Guy W. Lecky-Thompson, –Web Programmingl, Cengage Learning, 2008.
- 4. John Paul Mueller, Web Development with Microsoft Visual Studio 2005ll, Wiley Dream tech, 2006.
- 5. Roger S. Pressman, David Lowe, –Web Engineeringl, Tata McGraw Hill Publication, 2007.



| 17BAZ01- RESEARCH METHODOLOGY   |   |     |  |   |                     |   |   |  |  |  |  |
|---------------------------------|---|-----|--|---|---------------------|---|---|--|--|--|--|
|                                 |   |     |  | L | Т                   | Р | С |  |  |  |  |
|                                 |   |     |  | 3 | 0                   | 0 | 3 |  |  |  |  |
| PREI                            | REQUISITE: NIL  |     |  |   |                     |   |   |  |  |  |  |
| COURSE OBJECTIVES AND OUTCOMES: |   |     |  |   |                     |   |   |  |  |  |  |
| Course Objectives               |   |     | Course Outcomes  |   | Program outcomes    |   |   |  |  |  |  |
| 1.0                             | To understand the basic concepts of<br>research and its methodologies,<br>sources of information for literature<br>review | 1.1 | Demonstrate the concepts of research<br>and its methodologies, sources of<br>information for literature review     | a | a,c,d,e,f,g,h,j,k,l |   |   |  |  |  |  |
| 2.0                             | To identify the various procedures to formulate appropriate research design, data collection and measurement.             | 2.1 | Formulate appropriate research design,<br>data collection and conduct the<br>experiments using systematic methods. | a | a,b,c,e,f,g,h,i,k,l |   |   |  |  |  |  |
| 3.0                             | To summarize various methods for data preparation and analysis  | 3.1 | Identify the design for coding, editing and analysis of data   | k | b,c,d,e,f,g,h,i,j,k |   |   |  |  |  |  |
| 4.0                             | To provide knowledge of report<br>types, report writing and guidelines  | 4.1 | Choose the process like drawing and drafting tools and reviewing research  |   | c,d,e,f,g,h,i,j,k,l |   |   |  |  |  |  |
| 5.0                             | To summarize the Intellectual property rights and Ethics in research  | 5.1 | Formulate the design for Intellectual<br>property rights and code of ethics  |   | b,c,d,e,f,h,i,j,k,l |   |   |  |  |  |  |

#### UNIT I : INTRODUCTION

Research methodology - Understanding the language of research – Concepts, constructs, operational definitions, variables, propositions, hypotheses, theories, and models - Research process- Literature review -Types of research.

#### UNIT II : RESEARCH DESIGN, DATA COLLECTION AND MEASUREMENT

Problem identification and formulation - Research question – Research hypothesis - Measurement issues - Methods of data collection Types of data- Primary data- Scales of measurement- Sources and collection of data Observation method- Interview method– Survey- Experiments- Secondary data-Research design- Qualitative and Quantitative Research.

#### UNIT III : DATA PREPARATION AND ANALYSIS

Processing and analysis of data- Sampling- Steps and characteristics of sampling design Sampling: concepts of Population, Sample, Sampling Frame, - Sample size and its determination - Types of sampling distributions - Sampling error - Statistics in research Descriptive statistics and inferential statistics- Measures of central tendency, dispersion, skewness, asymmetry- Measures of relationship- Correlation and regression- Simple regression analysis- Multiple regression -Hypothesis Testing - parametric and non-parametric tests- Analysis of single factor experiments.

## UNIT IV : REPORT WRITING AND DESIGN

Reporting and presenting research - Written and oral communications -Hallmark of great scientific writing-The reading toolkit - Pre-writing considerations - Format of dissertations-Drawing and Drafting Tools, research reports, and research papers – Paper title and keywords – Writing an abstract – Writing the different sections of a paper - Revising a paper - Responding to peer reviews - Reviewing research papers - Plagiarism - Conference and poster presentations - Language aspects of report writing -Verb, tense and voice in scientific writing - Errors in grammar - Sentence and

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paragraph constructions -Paraphrasing - Measures of research impact.

#### UNIT V : INTELLECTUAL PROPERTY RIGHTS AND ETHICS IN RESEARCH

Intellectual property rights-Co-creation Methodology to make products from projects - Copyright - Patents - The codes of ethics - Avoiding the problems of biased survey -Occupational health and safety.

#### TOTAL : L: 45 = 45 PERIODS

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#### **REFERENCES:**

- 1. Cooper, D. R. and Schindler, P. S., (2009), Business Research Methods, Tata McGraw Hill, 9th Edition.
- 2. Jackson, S.L., Research Methods and Statistics, Cengage Learning India Private Limited, New Delhi, 2009
- 3. Krishnaswamy, K.N., Sivakumar, A.I., and Mathirajan, M., *Management Research Methodology*, Pearson Education , 2006.
- 4. Lebrun, J-L., *Scientific Writing: A Reader and Writer's Guide*, World Scientific Publishing Co. Pte. Ltd., Singapore, 2007.
- 5. MLA, MLA Handbook for Writers of Research papers, Seventh Edition, Affiliated East West Press Pvt Ltd, New Delhi, 2009.
- 6. Thiel, D. V., Research Methods for Engineers, Cambridge University Press, 2014.

