# First Year PG in Computer Science and Engg.
## Syllabus Structure (2015-16)
## *SEMESTER – I*

| Subject code | Subject | Teaching scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks%) | |
| | | | | | | | Max | Min for passing | | Max | Min for passing |
| CSE5011 | Research Methodology | 2 | - | - | 2 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5031 | Applied Algorithms | 3 | 1 | - | 4 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5051 | Distributed Database Systems | 3 | 1 | - | 4 | ISE | 20 | | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| PE-I | Program Elective-I | 3 | 1 | - | 4 | ISE | 20 | | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5151 | Web Development Lab-I | 2 | - | 2 | 3 | ISE | - | - | - | 50 | 50% |
| | | | | | | ESE | - | | | 50 | 50% |
| CSE5171 | Problem Solving Technique Lab | - | - | 4 | 2 | ISE | - | - | | 50 | 50% |
| | | | | | | ESE | - | | | 50 | 50% |
| CSE5191 | Optimization Techniques Lab | - | - | 4 | 2 | ISE | - | - | | 50 | 50% |
| | | | | | | ESE | - | | | 50 | 50% |
| CSE5211 | Research Methodology Lab | - | - | 2 | 1 | ISE | - | - | | 100 | 50% |
| CSE5231 | Seminar | - | - | 2 | 2 | ISE | - | - | | 100 | 50% |
| | | 13 | 3 | 14 | 24 | | | | | | |

Total Contact Hours / week =30, Total Credits = 24

ISE - In Semester Evaluation, MSE - Mid Semester Exam, ESE - End Semester Exam

## *SEMESTER – II*

| Subject code | Subject | Teaching scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks%) | |
| | | | | | | | Max | Min for passing | | Max | Min for passing |
| CSE5021 | Cloud Computing | 3 | - | - | 3 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5041 | Parallel Algorithms & Design | 3 | 1 | - | 4 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| PE-II | Program Elective-II | 3 | - | - | 3 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| IET522 | Advanced engineering Mathematics | 3 | - | - | 3 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| IE-I | Institute Elective (Open) | 3 | - | - | 3 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5161 | Web development Lab-II | 2 | - | 2 | 3 | ISE | - | - | | 50 | 50% |
| | | | | | | ESE | - | | | 50 | 50% |
| CSE5181 | High Performance Computing Lab | - | - | 2 | 1 | ISE | - | | | 50 | 50% |
| | | | | | | ESE | | | | 50 | 50% |
| CSE5201 | Mini-project | - | - | 2 | 2 | ISE | - | | | 100 | 50% |
| IEO523 | Proficiency in technical Communication | - | - | 2 | 1 | ISE | - | | - | 50 | 50 % |
| CSE5221 | Comprehensive viva voce | - | - | | 1 | ESE | - | | - | 100 | 50% |
| | | 17 | 1 | 8 | 24 | | | | | | |

Total Contact Hours / week = 26, Total Credits = 24

ISE - In Semester Evaluation, MSE - Mid Semester Exam, ESE - End Semester Exam.

## Second Year PG CSE Syllabus Structure 2015-16
## Semester III

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) Max | (Marks %) Min for passing |
| CSE6011 | Field /Professional Training | - | - | - | 2 | ISE | 2 | 100 | 50% |
| CSE6051 | Dissertation Stage I | - | - | 5* | 4 | ISE | 4 | 100 | 50% |
| CSE6071 | Dissertation Stage II | | | | 10 | ISE | 4 | 40 | 50% |
| CSE6091 | | | | | | ESE | 6 | 60 | 50% |
| Total Credits | | | | | 16 | | | | |
| Total Contact Hours/Week | | | | | 5* | | | | |

*Average contact hours/week/student.

# Semester IV

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) Max | (Marks %) Min for passing |
| CSE6021 | Dissertation Stage III | - | - | 5* | 8 | ISE | 4 | 100 | 50% |
| CSE6041 | Dissertation Stage IV | | | | 10 | ISE | 4 | 40 | 50% |
| CSE6061 | | | | | | ESE | 6 | 60 | 50% |
| Total Credits | | | | | 18 | | | | |
| Total Contact Hours/Week | | | | | 5* | | | | |

* Average contact hours/week/student.

**Grand Total of Credits: 24+24+16+18 = 82**

## List of Program Electives

### Semester I: Program Elective I

| No. | Name of Course |
|---|---|
| CSE5071 | Natural language processing |
| CSE5091 | Advanced Software Engineering |
| CSE5111 | Image Processing and Analysis |

### Semester II: Program Elective II

| No. | Name of Course |
|---|---|
| CSE5061 | Big Data Analytics |
| CSE5081 | Software Architecture |
| CSE5101 | Intellectual Property Rights & Cyber Laws |

### Semester II: Institute Elective I

| No. | Name of Course |
|---|---|
| IEO5101 | Advance Networks |

# Department of Computer Science and Engineering

## M Tech Computer Science and Engineering

# Structure and Syllabus

**2015-16**

# First Year PG in Computer Science and Engg.
## Syllabus Structure (2015-16)
## *SEMESTER – I*

| Subject code | Subject | Teaching scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks%) | |
| | | | | | | | Max | Min for passing | | Max | Min for passing |
| CSE5011 | Research Methodology | 2 | - | - | 2 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5031 | Applied Algorithms | 3 | 1 | - | 4 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5051 | Distributed Database Systems | 3 | 1 | - | 4 | ISE | 20 | | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| PE-I | Program Elective-I | 3 | 1 | - | 4 | ISE | 20 | | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5151 | Web Development Lab-I | 2 | - | 2 | 3 | ISE | - | - | - | 50 | 50% |
| | | | | | | ESE | - | | | 50 | 50% |
| CSE5171 | Problem Solving Technique Lab | - | - | 4 | 2 | ISE | - | - | | 50 | 50% |
| | | | | | | ESE | - | | | 50 | 50% |
| CSE5191 | Optimization Techniques Lab | - | - | 4 | 2 | ISE | - | - | | 50 | 50% |
| | | | | | | ESE | - | | | 50 | 50% |
| CSE5211 | Research Methodology Lab | - | - | 2 | 1 | ISE | - | - | | 100 | 50% |
| CSE5231 | Seminar | - | - | 2 | 2 | ISE | - | - | | 100 | 50% |
| | | 13 | 3 | 14 | 24 | | | | | | |

Total Contact Hours / week =30, Total Credits = 24

ISE - In Semester Evaluation, MSE - Mid Semester Exam, ESE - End Semester Exam

## *SEMESTER – II*

| Subject code | Subject | Teaching scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks%) | |
| | | | | | | | Max | Min for passing | | Max | Min for passing |
| CSE5021 | Cloud Computing | 3 | - | - | 3 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5041 | Parallel Algorithms & Design | 3 | 1 | - | 4 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| PE-II | Program Elective-II | 3 | - | - | 3 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| IET522 | Advanced engineering Mathematics | 3 | - | - | 3 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| IE-I | Institute Elective (Open) | 3 | - | - | 3 | ISE | 20 | - | 40% | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40% | | | |
| CSE5161 | Web development Lab-II | 2 | - | 2 | 3 | ISE | - | - | | 50 | 50% |
| | | | | | | ESE | - | | | 50 | 50% |
| CSE5181 | High Performance Computing Lab | - | - | 2 | 1 | ISE | - | | | 50 | 50% |
| | | | | | | ESE | | | | 50 | 50% |
| CSE5201 | Mini-project | - | - | 2 | 2 | ISE | - | | | 100 | 50% |
| IEO523 | Proficiency in technical Communication | - | - | 2 | 1 | ISE | - | | - | 50 | 50 % |
| CSE5221 | Comprehensive viva voce | - | - | | 1 | ESE | - | | - | 100 | 50% |
| | | 17 | 1 | 8 | 24 | | | | | | |

Total Contact Hours / week = 26, Total Credits = 24

ISE - In Semester Evaluation, MSE - Mid Semester Exam, ESE - End Semester Exam.

## Second Year PG CSE Syllabus Structure 2015-16
## Semester III

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) Max | (Marks %) Min for passing |
| CSE6011 | Field /Professional Training | - | - | - | 2 | ISE | 2 | 100 | 50% |
| CSE6051 | Dissertation Stage I | - | - | 5* | 4 | ISE | 4 | 100 | 50% |
| CSE6071 | Dissertation Stage II | | | | 10 | ISE | 4 | 40 | 50% |
| CSE6091 | | | | | | ESE | 6 | 60 | 50% |
| Total Credits | | | | | 16 | | | | |
| Total Contact Hours/Week | | | | | 5* | | | | |

*Average contact hours/week/student.

# Semester IV

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) Max | (Marks %) Min for passing |
| CSE6021 | Dissertation Stage III | - | - | 5* | 8 | ISE | 4 | 100 | 50% |
| CSE6041 | Dissertation Stage IV | | | | 10 | ISE | 4 | 40 | 50% |
| CSE6061 | | | | | | ESE | 6 | 60 | 50% |
| Total Credits | | | | | 18 | | | | |
| Total Contact Hours/Week | | | | | 5* | | | | |

* Average contact hours/week/student.

**Grand Total of Credits: 24+24+16+18 = 82**

## List of Program Electives

### Semester I: Program Elective I

| No. | Name of Course |
|---|---|
| CSE5071 | Natural language processing |
| CSE5091 | Advanced Software Engineering |
| CSE5111 | Image Processing and Analysis |

### Semester II: Program Elective II

| No. | Name of Course |
|---|---|
| CSE5061 | Big Data Analytics |
| CSE5081 | Software Architecture |
| CSE5101 | Intellectual Property Rights & Cyber Laws |

### Semester II: Institute Elective I

| No. | Name of Course |
|---|---|
| IEO5101 | Advance Networks |

## Semester I
## CSE5011: Research Methodology

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5011 | Research Methodology | 2 | - | - | 2 | ISE | 20 | - | 40 % | - | - |
| | | | | | | MSE | 30 | | | | |
| | | | | | | ESE | 50 | 40 % | | | |

**Course Description:**

The principal objective of this subject is to give an insight into the steps to be followed in doing a research and provide an idea about technical report writing etc. This course focus on student individual participation to identify and make a literature survey on the topic of his/her interest. The student can refer to doctoral thesis / referred journal papers / books / conference paper / reports etc. This course also focuses on use of design methods, quantitative analysis methods and tools for complete any research work. This course also covers issues of Research ethics, scholarly publishing and IPR.

**Course Learning Outcomes:** After completion of this course the students will be able to

1. Identify research problem.
2. Do the literature review, finalize and formulate the problem statement
3. Identify / develop the suitable methodology and methods for the research problem
4. Apply quantitative methods for analyzing the results
5. Develop a report
6. To function in teams and to communicate effectively.

**Prerequisites:**

- Basic knowledge of computer science & engineering and mathematics
- Basic understanding of different software tool

# SYLLABUS

## SECTION – I

| **Unit 1: Research Methodology and research process** | **5 hrs** |
|---|---|
| Definition of research and characteristics of research, Types of research, Research process: Formulating the Research Problem, Literature Review, Developing the objectives, preparing the Research Design including Sample Design, Collecting the Data, Analysis of Data, Generalization and Interpretation, Preparation of the Report or Presentation of Results. | |

| **Unit 2: Literature survey** | **5 hrs** |
|---|---|
| Importance of literature review, types of literature review, selection of the review topic, searching for the literature, analyzing and synthesizing the literature, writing the review report. | |

| **Unit 3: Statistical tools for analysis** | **5 hrs** |
|---|---|
| Analysis of variance, regression analysis, Response surface methods for process optimization. | |

## SECTION – II

| **Unit 4: Design and analysis of experiments** | **5 hrs** |
|---|---|
| Strategy of experimentation, Statistical design of experiments, replication, randomization and blocking. Guidelines for designing experiments, Factorial designs. The two factor factorial design, Statistical analysis of factorial design, Taguchi design. | |

| **Unit 5: Writing a research proposal** | **4 hrs** |
|---|---|
| Title, Abstract, Introduction, Rationale, Objectives, Methodology, Time frame and work plan, Budget and Justification, References | |

| **Unit 6: Research ethics, scholarly publishing and IPR** | **2 hrs** |
|---|---|
| Ethics – ethical issues, Scholarly publishing – selection of journal, citation, acknowledgement, plagiarism. IPR - intellectual property rights, patent law | |

**References**

1. Kothari C.K. (2004) 2/e, Research Methodoloy – Methods and Techniques (New Age International, New Delhi)
2. Krishnswamy, K.N., Shivkumar, Appa Iyer and Mathiranjan M. (2006) Management Research Methodology; Integration of Principles, Methods and Techniques (Pearson Education, New Delhi)
3. Gupta, Santosh (2005) Research Methodology and Statistical Techniques, Deep and Deep Publications.
4. Douglas C. Montgomery, Design and analysis of experiments, John Willey and Sons, New York.
5. Tapan Bagchi, Taguchi Methods Explained: Practical steps to robust design, Prentice Hall
6. Phillip J. Ross, Taguchi Techniques for quality engineering, TATA McGraw Hill

## Semester I
## CSE5031: Applied Algorithms

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5031 | Applied Algorithms | 3 | 1 | - | 4 | ISE | 20 | - | 40 % | - | - |
| | | | | | | MSE | 30 | | | - | - |
| | | | | | | ESE | 50 | 40 % | | - | - |

**Course Description:**

The goal of this course is to study both classical and advanced algorithm design techniques with emphasis on real-world applications. This course makes students aware about algorithms, design techniques and application areas. This course contains different algorithm design techniques, linear programming and heuristic techniques. The focus of the course is to understand the basics and recent trends of algorithms.

**Course Learning Outcomes:**

On completion of this course student should be able to:

1. Select appropriate algorithm methodology for problem.
2. Formulate engineering problems as mathematical optimization problems
3. Design and implement new algorithms.
4. Find the new trends and research directions in algorithms.

**Prerequisites:**

- Data structure, Programming Languages, Mathematics

# SYLLABUS

## SECTION – I

| **Unit 1: Fundamental of Algorithm** | **6 hrs** |
|---|---|
| Algorithm, Analyzing algorithms, Divide and Conquer method, Greedy method, Probabilistic Analysis and Randomized Algorithms. | |

| **Unit 2: Graph based Techniques** | **6 hrs** |
|---|---|
| Breadth first search, Depth first search, Chronological Backtracking and its variations, Applications. | |

| **Unit 3: Linear Programming** | **6 hrs** |
|---|---|
| Problem definitions and solution techniques, Reductions, Maximum matching, Transportation, assignment techniques. | |

## SECTION – II

| **Unit 4: Local Heuristic Techniques** | **6 hrs** |
|---|---|
| NP-completeness review, Local Search, Hill climbing, Tabu search. | |

| **Unit 5: Global Heuristic Techniques** | **6 hrs** |
|---|---|
| Global search, Genetic Algorithms (GA), Teaching Learning Based Optimization Algorithm. | |

| **Unit 6: Introduction to Parallel Algorithms** | **6 hrs** |
|---|---|
| Introduction, Why Parallel Architecture, Convergence of Parallel Architectures, Communication Architecture, Shared Memory, Message-Passing, Convergence, Data Parallel Processing, Other Parallel Architectures, Fundamental Design Issues. | |

**References**

1. Ellis Horowitz, Sartaj Sahni and Sanguthewar Rajaselaran, "Fundamentals of Computer Algorithms", Galgotia publications.
2. Thomas H. Cormen, Charles S. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI – 2nd edition.
3. Aho, Hopcraft & Ulman, "The Design and Analysis of Computer Algorithms", Pearson Education.
4. H.A. Taha, "Operations Research: An Introduction", 5th Edition, Macmillan, New York, 1992.
5. David E Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison Wesley, New Delhi, 1989.
6. R. V. Rao and V. J. Savsani, "Mechanical Design Optimization Using Advanced Optimization Techniques", Springer Series in Advanced Manufacturing - Springer-Verlag London 2012.

7. Parallel Computer Architecture - A Hardware / Software Approach - David Culler University of California, Berkeley, Jaswinder Pal Singh Princeton University with Anoop Gupta Stanford University.

## Semester I

## CSE5051: Distributed Database Systems

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5051 | Distributed Database Systems | 3 | 1 | - | 4 | ISE | 20 | | | - | - |
| | | | | | | MSE | 30 | | 40 % | - | - |
| | | | | | | ESE | 50 | 40 % | | - | - |

**Course Description:**

The course helps to study innovative database systems to work on real time applications & Engg. practice. To study the objective that how Advance Database Engg. helps in storing of various records & advantages over RDBMS. It Includes advance concepts like design of distributed database systems, query processing in DDBS and current issues of distributed in cloud computing areas.

**Course Learning Outcomes:**

On completion of the subject the student should be able to:

1. Define various Database Systems & its types.
2. Analyze architectures of distributed data base sytsems.
3. Synthesize the models of query processing.
4. Apply distributed database concepts to optimize the queries.
5. Experiment the active DBs & real-time DBs.

**Prerequisites:**

- **Basic data base concepts.**
- **Distributed Systems.**

# SYLLABUS

## SECTION – I

| **Unit 1: Introduction to DDBMS and distributed DDBMS architecture** | **6** |
|---|---|
| Distributed data processing, Distributed database systems (DDBS),Promises of DDBMS, Completing factors and problem areas, DBMS standardization, Architectural models for DDBMS, DDBMS architecture and Global directory issues. | |

| **Unit 2: Distributed Database Design** | **6** |
|---|---|
| Alternative design strategies, Distributed design issues, Fragmentation and allocation. | |

| **Unit 3: Distributed Query Processing** | **6** |
|---|---|
| Query Processing, Problem Objectives of Query Processing, Complexity of Relational Algebra operations, Characterization of Query Processors, Layers of Query Processing. | |

## SECTION – II

| **Unit 4: Introduction to Transaction Management and Concurrency Control** | **6** |
|---|---|
| Definition of a Transaction, Properties of Transactions, Types of Transactions, Serializability Theory, Taxonomy of Concurrency Control Mechanisms, Locking-Based Concurrency Control Algorithms, Timestamp-Based Concurrency Control Algorithms. | |

| **Unit 5: Optimization of Distributed Queries** | **6** |
|---|---|
| Query Optimization, Centralized Query Optimization, Join Ordering in Distributed Queries, Distributed Query Optimization. | |

| **Unit 6: Current Issues: Streaming Data and Cloud Computing** | **6** |
|---|---|
| Data Stream Management, Cloud Data Management. | |

**References:**

1. Principles of Distributed Database Systems; 2nd Edition
By M. Tamer Ozsu and Patrick Valduriez Publishers: Person Education Asia
ISBN: 81-7808-375-2

2. Database System Concepts – Silberschatz, korth & Sudarshan (McGrawHill) 5th Edition.

3. Database systems (2nd edition) By Raghuramakrishnan and Johannes

4. Distributed Database; Principles & Systems By Stefano Ceri and Giuseppo Pelagatti
Publications: McGraw-Hill International Editions
ISBN: 0-07-010829-3

## Semester I

## CSE5071: Natural Language Processing (Program Elective-I)

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5071 | Natural Language Processing (Program Elective-I) | 3 | 1 | - | 4 | ISE | 20 | | | - | - |
| | | | | | | MSE | 30 | | 40% | - | - |
| | | | | | | ESE | 50 | 40% | | - | - |

**Course Description:**

The course introduces the fundamental concepts and ideas in natural language processing (NLP). It focuses on subfields of NLP like: **Words** (which are fundamental building blocks of language), **Syntax** (which represent the formal relationship between the words i.e. Structure of a sentence), **Semantics** (which concerns with determining the explicit meaning of a single sentence), and **Pragmatics** (which concerns with deriving the implicit meaning of a sentence when it is used in a specific discourse context). The course will introduce both knowledge-based and statistical approaches to NLP.

**Course Learning Outcomes:**

On completion of this course the student will be able to:

1. Predict the Regular expression, do the morphological parsing by designing Finite State Transducer (FST) and comprehend the concept of computational phonology.
2. Discuss NLP applications, along with problems or task, addressed the materials and methods used to evaluate the applications, and opportunities for future developments for each application.
3. Identify the major issues in Natural Language Processing and discuss different approaches to their solution.
4. Understand and apply the basic algorithms, technique to various text and speech applications.
5. Perform lexical, syntactic, semantic and pragmatic analysis.

**Prerequisites:**

- Finite automata.
- Machine learning.

# SYLLABUS

## SECTION – I

| **Unit 1: Regular Expression and Automata** | **(06)** |
|---|---|
| Regular Expressions, Regular Language, Applications of Regular Expression, Finite State Automata- Deterministic FSAs , Nondeterministic FSAs, Equivalence of FA's | |

| **Unit 2: Morphology and Finite State Transducer** | **(06)** |
|---|---|
| Morphology: Inflectional & Derivational, Finite-state Morphological Parsing, Morphological Parsing with Finite-State Transducers, Combining FST lexicon and rules | |

| **Unit 3: Computational Phonology and Text-to-Speech** | **(06)** |
|---|---|
| Computational Phonology, Text-to-Speech, Probabilistic Models of Pronunciation and Spelling, N-grams, Hidden Markov models (HMMs) and Speech Recognition | |

## SECTION – II

| **Unit 4: Syntax Analysis** | **(07)** |
|---|---|
| Word classes and Part-of-speech tagging, Context Free Grammar, Parsing with CFGs: Top Down Parsing, Bottom Up Parsing , Basic Top-Down Parser , Problems with basic top down parser, The Earley Algorithm, Probabilistic CFGs, Probabilistic CYK Parsing of PCFGs. | |

| **Unit 5: Semantic Analysis** | **(06)** |
|---|---|
| Representing Meaning, Semantic Analysis, Lexical Semantics, Word Sense Disambiguation and Information Retrieval. | |

| **Unit 6: Pragmatics** | **(05)** |
|---|---|
| Discourse: Reference Resolution, Text Coherence and Discourse structure, Natural Language Generation: Introduction, Architecture, Surface Realization, Discourse planning. | |

**References:**

1. "Speech and Language Processing", Daniel Jurafsky and James H. Martin, PHI, 1st edition (January 26, 2000)ISBN: 0130950696

2. "Natural Language Processing and Information Retrieval" , U. S. Tiwary and Tanveer Siddiqui , Oxford University Press (7 April 2008), ISBN-13: 978-0195692327

3. "Fundamentals of Statistical Natural Language Processing"- Chris Manning and Hinrich Schuetze , MIT Press; 1st edition (June 18,1999) ISBN: 0262133601.

## Semester I
## CSE5091: Advanced Software Engineering (Program Elective-I)

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | Max | Min for Passing |
| CSE5091 | (Program Elective–I) Advanced Software Engineering | 3 | 1 | - | 4 | ISE | 20 | | - | - |
| | | | | | | MSE | 30 | 40 % | - | - |
| | | | | | | ESE | 50 | 40 % | - | - |

**Course Description:**

This course aims to guide students in both the theoretical and practical aspects of developing computer solutions for real-world problems. This course is designed to present students with an overview of advanced topics in software engineering. This course will cover software engineering topics associated with large systems developments such as requirement and specifications, testing and maintenance, and design.

**Course Learning Outcomes:**

On successful completion of this course, the student should able to:

1. Demonstrate knowledge of the wider software engineering context, software engineering processes and their applicability
2. Apply professional practices in managing the development of quality software
3. Describe the issues affecting the organization, planning and control of software based system development
4. Demonstrate and run a small software intensive system development project
5. Describe emerging trends in Software Engineering

**Prerequisites:**

- Basics of software Engineering
- Software development experiences in programming languages

# SYLLABUS

## SECTION – I

| **Unit 1: Software and Software Engineering** | **4 hrs** |
|---|---|
| The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths | |

| **Unit 2: Software Process: Process Models** | **7 hrs** |
|---|---|
| A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology, Product and Process, Summary. Agile Development: What Is Agility? Agility and the Cost of Change, What is an Agile Process? Extreme Programming (XP), Other Agile Process Models, a Tool Set for the Agile Process | |

| **Unit 3: Quality Concepts and Software Quality Assurance** | **7 hrs** |
|---|---|
| What is Quality? Software Quality, The Software Quality Dilemma, Achieving Software Quality, Summary, Background Issues, Elements of Software Quality Assurance, SQA Tasks, Goals, and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Software Reliability. | |

## SECTION – II

| **Unit 4: Managing Software Projects** | **7 hrs** |
|---|---|
| Project Management Concepts – The Management Spectrum, The People, The Product, The Process, The Project, The $W^5HH$ Principle, Critical Practices, summary, Project Scheduling – Basic Concepts, Project Scheduling, Defining a Task Set for the Software Project, Defining a Task Network, Scheduling, Earned Value Analysis | |

| **Unit 5: Software Process Improvement** | **4 hrs** |
|---|---|
| What Is SPI? The SPI Process, the CMMI, the People CMM, Other SPI Frameworks, SPI Return on Investment, SPI Trends. | |

| **Unit 6: Emerging Trends in Software Engineering** | **7 hrs** |
|---|---|
| Technology Evolution, Observing Software Engineering Trends, Identifying "Soft Trends", Technology Directions, Tools-Related Trends, Summary. | |

**References**

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", 7th Ed., McGraw-Hill, 2010
2. Ghezzi, Jazayeri, Mandrioli, "Fundamentals of Software Engineering", 2/Ed, Pearson Education, 2002
3. Ian Sommerville, "Software Engineering", 6/Ed, Pearson Education, 2006.

## Semester I
## CSE5111: Image Processing and Analysis (Program Elective–I)

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5111 | (Program Elective–I) Image Processing and Analysis | 3 | 1 | - | 4 | ISE | 20 | | | - | - |
| | | | | | | MSE | 30 | | 40 % | - | - |
| | | | | | | ESE | 50 | 40 % | | - | - |

**Course Description:**

Image processing and analysis is one of the fundamental tools of applied remote sensing. It is the means by which information can be extracted from raw digital data to produce and manipulate images from airborne and space sensors. This course covers the fundamental concepts and methods of image processing and analysis. Also module presents the principal tools and algorithms designed to enhance the image quality, to detect, segment and recognize the different objects that compose the image. These methods are widely used in numerous applications related to satellite imaging, medical imaging, industrial vision, document analysis, etc. Also this course covers Morphological and color image processing methods.

**Course Learning Outcomes:**

On successful completion of this course, student should be able to:

1. Categorize and apply the general methods by which images are acquired
2. Analyze and develop imaging solutions for practical applications
3. Apply general image processing principles
4. Operate and manage an image processing system
5. Describe the use morphological operations on binary images

**Prerequisites:**

- Knowledge of linear algebra and calculus in variables

# SYLLABUS

## SECTION – I

| **Unit 1: Image sampling and quantization Image enhancement** | **5 hrs** |
|---|---|
| Filters in spatial and frequency domains, histogram-based processing, homomorphic filtering. | |

| **Unit 2: Image Segmentation** | **7 hrs** |
|---|---|
| Point, line and edge detection, edge linking and boundary detection, thresholding, region based Segmentation. | |

| **Unit 3: Morphological Image processing** | **5 hrs** |
|---|---|
| dilation and erosion, basic morphological algorithms | |

## SECTION – II

| **Unit 4: Color Image processing** | **6 hrs** |
|---|---|
| Color models, color transformation, smoothing, sharpening, color segmentation. | |

| **Unit 5: Two dimensional orthogonal transforms** | **8 hrs** |
|---|---|
| DFT, FFT, WHT, Haar transform, KLT, DCT | |

| **Unit 6: Image attribute representation and description** | **5 hrs** |
|---|---|
| Boundary descriptors, regional descriptors | |

**References**

8. Gonzalez and Woods, Digital Image Processing, Pearson Education.
9. Woods and Eddins, Digital Image Processing using Matlab, Gonzalez, Pearson Education.
10. Milan Sonka, Vaclav Hlavac,Roger Bole, Image processing , Analysis and Machine Vision, ITP
11. Chanda D. Majumdar, Digital Image Processing and Analysis, PHI.
12. Pratt W.K, Digital Image Processing, John Wiley & Sons

## Semester I

## CSE5151: Web Development Laboratory-I

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | Max | Min for Passing |
| CSE5151 | Web Development Laboratory-I | 2 | - | 2 | 3 | ISE | - | - - | 50 | 50% |
| | | | | | | ESE | - | | 50 | 50% |

**Course Description:**

Most organizations have online presence in the form of web applications. Web application is a key aspect of modern life and business. There is a high demand for graduates with the skills and expertise to design, develop and maintain the highly usable feature-rich web applications. The course will provide a good preparation for those who wish to pursue a career in web development either in an IT company or as a self-employed entrepreneur.

This course will expose students to the techniques used in programming web pages for interactive content. The course covers the design, creation, and deployment of web pages and web applications. Rendering a website works by combining server side technologies with client side technologies. The course begins by reviewing basic web technologies (HTML, CSS style sheets) and exploring the use of event-driven programming in JavaScript to add interactive elements such as buttons and text fields to web pages. Next, students will learn to use PHP at a good depth, which is presently a popular server side programming technique. The course also makes students aware about web services and various frameworks used by Industries for web application developments

**Course Learning Outcomes:**

1. Gain technical competencies in web application development and maintenance.
2. Implement interactive web pages and apply validation checks using client side programming languages like HTML, CSS and Java Script.
3. Process the business data and generate responses dynamically using PHP.
4. Design and develop web services.
5. Use web application development frameworks for designing web applications.

**Prerequisites:**

- Acquaintance with the Computers and Internet.
- Knowledge of Java and C# programming.

# SYLLABUS

## SECTION – I

| **Unit 1:HTML5 and CSS3** | **(4)** |
|---|---|
| Web Development Introduction.HTML5: Introduction and Basic, Forms, Elements, Graphics, Media. CSS3: Introduction, Types of CSS, Selector and Pseudo-Classes, Transform, Ribbons, Gradients, Shadow. | |

| **Unit 2:JavaScript and JQuery** | **(4)** |
|---|---|
| JavaScript: Introduction, Forms, Objects, Functions, Dialog boxes. JQuery: Introduction, Events, Effects, Traversing, Ajax. | |

| **Unit 3:Fundamentals of PHP** | **(2)** |
|---|---|
| Introduction, Installation, Variables, Comments, Data types, Conditional and Looping structure, Operators functions, Arrays and Object oriented programming in PHP. | |

## SECTION – II

| **Unit 4:Advanced PHP** | **(5)** |
|---|---|
| Super global variables, Input controls and Validation functions, Session Management, Database handling in PHP, JPGraph, GDLibrary. | |

| **Unit 5:Web Application Development Framework** | **(5)** |
|---|---|
| MVC architecture concept, Frameworkinstallation , Routing Basics , Creating Controller , Creating View , Creating Model of Code Igniter, CakePHP and Laravel. | |

| **Unit 6:WebServices** | **(4)** |
|---|---|
| What is WebService , Architecture, WebService Components , XML, SOAP Web Service ,RESTful Web Service, SOAP vs REST, SOA | |

**Text Books :**

1. Kogent Learning Solutions Inc. "HTML5 Black Book: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and Jquery", Dreamtech Press, First Edition, ISBN 9789350040959.
2. Html,Xthml,Css&Xml By Example by TeodoreGugoiu Publication -FIREWAL MEDIA

**Reference Books:**

1. Dave W. Mercer, Allan Kent, Steven D. Nowicki, David Mercer, "Beginning PHP5", WroxPublication, First Edition, ISBN 978-0764557835
2. Sagar S. Sawant&Ashwini B. Patil, "Commence Web Development with PHP and MySQL", Aruta Publication, First Edition, ISBN-978-93-81476-13-0
3. Sebastian Bergmann, Stefan Priebsch, "Real-World Solutions for Developing High-Quality PHP Frameworks and Applications", Wrox, ISBN:978-1-4571-0652-1.

## Semester I

## CSE5171: Problem Solving Techniques Lab

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5171 | Problem Solving Techniques Lab | - | - | 4 | 2 | ISE | - | - | - | 50 | 50 % |
| | | | | | | ESE | - | - | | 50 | 50 % |

**Course Description:**

The principal objective of this course is to study and implement different problem solving techniques and algorithms. This course focuses on the implementation of basic and advanced algorithms. This course explores the comparison of different techniques to solve basic building block problems and real world problems.

**Course Learning Outcomes:**

On completion of this subject the student will be able to:

1. Understand the basic data structures.
2. Understand and explore different problem solving techniques.
3. Design and implement new algorithms.

**Prerequisites:**

- Familiarity with basic data structures with searching and sorting algorithms.
- Familiarity with divide & conquer and greedy algorithm design techniques.

## SYLLABUS

The term work should consist of 4-6 practical assignments based on problem solving techniques. The practical assignments are to be given and evaluated by the respective subject teacher.

## Semester I

## CSE5191: Optimization Techniques Lab

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5191 | Optimization Techniques Lab | - | - | 4 | 2 | ISE | - | - | - | 50 | 50% |
| | | | | | | ESE | - | - | | 50 | 50% |

**Course Description:**

The principle objective of the Optimization Techniques Lab course is to introduce students about deterministic models in operations research with special emphasis on linear/Non-linear programming, integer programming, network flow, transportation models, traditional and non-traditional algorithms and their engineering and other diverse applications like breweries, hospitals, airlines, manufacturing industry, Multi-criteria decision etc. This course focuses on the modeling and implementation of different Optimization techniques for various applications. For programming students can use tools like Matlab/any other Optimization Techniques tools, programming languages like C/C++/Java, etc.

**Course Learning Outcomes:**

Upon successful completion of the course students should be able to:

1. Develop mathematical model for selected/assigned engineering or other real system.
2. Select suitable method to provide solution for the selected/assigned engineering or other real system.
3. Formulate the different applications as mathematical model.
4. Evaluate results and propose recommendations to decision making system.
5. Use different computational tools and programming languages to provide solution.

**Prerequisites:**

- Algorithms, Mathematics & Statistics and knowledge of Programming languages.

## SYLLABUS

The lab work should consist of 4-6 practical assignments which make use of different Optimization Techniques. The practical assignments are to be given and evaluated by the respective course coordinator. A journal is to be prepared by individual student and duly signed by the respective teacher to be submitted to the department at the end of the semester.

## Semester I

## CSE5211: Research Methodology laboratory

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5211 | Research Methodology laboratory | - | - | 2 | 1 | ISE | - | - | - | 100 | 50% |

**Course Description:**

The principal objective of this subject is to understand and execute the steps research methodology. This course focus on student individual participation to identify and make a literature survey on the topic of his/her interest. This course explores use of different methodologies, methods and techniques required to execute any research work.

**Course Learning Outcomes:** After completion of this course the students will be able to

7. Indentify research problem(s).
8. Do the literature review, finalize and formulate the problem statement
9. Identify / develop the suitable methodology and methods for the research problem
10. Apply quantitative methods for analyzing the results
11. Develop a report
12. To function in teams and to communicate effectively.

**Prerequisites:**

- Basic knowledge of computer science & engineering and mathematics
- Basic understanding of different software tool

# SYLLABUS

It is expected by the student to carry out following task for evaluations,

1. Literature Review: Writing a review based on research papers
2. Questionnaire design for data collection
3. Use of software for data analysis-I
4. Design and Analysis of Experiments-I
5. Design and Analysis of Experiments-II
6. Writing a research proposal

**References**

1. Kothari C.K. (2004) 2/e, Research Methodoloy – Methods and Techniques (New Age International, New Delhi)
2. Krishnswamy, K.N., Shivkumar, Appa Iyer and Mathiranjan M. (2006) Management Research Methodology; Integration of Principles, Methods and Techniques (Pearson Education, New Delhi)
3. Gupta, Santosh (2005) Research Methodology and Statistical Techniques, Deep and Deep Publications.
4. Douglas C. Montgomery, Design and analysis of experiments, John Willey and Sons, New York.
5. Tapan Bagchi, Taguchi Methods Explained: Practical steps to robust design, Prentice Hall
6. Phillip J. Ross, Taguchi Techniques for quality engineering, TATA McGraw Hill

## Semester I
## CSE5231: Seminar

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5231 | Seminar | - | - | 2 | 2 | ISE | - | - | - | 100 | 50 % |

**Course Description:**
The principal objective of this course is to focus on identifying new research areas and problems. It focus is on study and presentation of literature survey / review.

**Course Learning Outcomes:**
On completion of this subject the student will be able to:

1. Explore research areas and problems.
2. Present the finding of literature survey / review.
3. Find reputed journals and conference in relevant filed.

**Prerequisites:**

- Familiarity with basic subject of computer science and engineering.

## Syllabus

It is a course requirement under the guidance of faculty called as Supervisor. It is expected by the student to carry out exhaustive literature survey with consultation of his/her Supervisor for not less than 15 reputed national / international journal and conference papers. Student should present the survey report to DPGC and justify about the innovativeness, applicability, relevance and significance of the work. Student shall submit seminar report as per the prescribed format in 02 copies to department

## Semester II

## CSE5021: Cloud Computing

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5021 | Cloud Computing | 3 | - | - | 3 | ISE | 20 | | | - | - |
| | | | | | | MSE | 30 | | 40 % | - | - |
| | | | | | | ESE | 50 | 40 % | | - | - |

**Course Description:**

The principal objective of this subject is to introduce students to cloud computing basics and research advances. It introduces cloud computing from two perspectives, one technological development issues and second business related issues. This course contains basic definitions, architectures, types and models of cloud computing. It explores enabler technologies, Cloud security model and optimization problems. This course also covers the business and adoption issues.

**Course Learning Outcomes:**

On completion of this subject the student will be able to:

1. Understand the technological changes in computer industry form last 50 years.
2. Understand the types, components and models of cloud computing.
3. Investigate the influence of different enablers and standards on cloud computing.
4. Explore the different optimization problems in cloud computing.
5. Explore the business issues and impact of cloud computing of small and medium scale industry.

**Prerequisites:**

- Basic knowledge computing like client server, World Wide Web.
- Basic knowledge of operating systems and computer networks.

# SYLLABUS

## SECTION – I

| **Unit 1: Cloud Computing Overview** | **7 hrs** |
|---|---|
| Definition, features of cloud computing, components, service models, deployment models, mainframe to cloud- advantages and limitations, comparing cloud providers with traditional IT service providers. | |

| **Unit 2: Cloud computing and it's enabler technologies** | **6 hrs** |
|---|---|
| Study of cloud computing and it's enabler technologies such as virtualization, utility computing, grid computing etc. History, different architectures, features, role of these technologies in cloud computing development. | |

| **Unit 3: Cloud Security** | **5 hrs** |
|---|---|
| Cloud security challenges, Cloud security approaches: encryption, tokenization/obfuscation, cloud security alliance, standards, cloud security models and related patterns, Cloud security in mainstream vendor solutions. | |

## SECTION – I

| **Unit 4: Optimization problems in cloud computing** | **6 hrs** |
|---|---|
| Resource provisioning, resource allocation, load balancing, power optimization, workflow scheduling problems. | |

| **Unit 5: Business related issues** | **6 hrs** |
|---|---|
| Service level Agreements, licensing strategies, billing and accounting, cost benefits offered by cloud computing, Financial aspects of cloud computing, Total cost of ownership. | |

| **Unit 6: Cloud Adoption and deployment issues** | **5 hrs** |
|---|---|
| Enterprise Cloud drivers and adoption trends, cloud adoption issues and framework, Impact of cloud on different industries like banking, software and telecommunication, Quantitative evaluation of the impact of the cloud, Cloud ROI models. | |

**References**

1. Cloud Computing: Principles and Paradigms, Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski. (John Wiley & Sons, Inc.)
2. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)

## Semester II

## CSE5041: Parallel Algorithms and Design

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5041 | Parallel Algorithms and Design | 3 | 1 | - | 4 | ISE | 20 | | | - | - |
| | | | | | | MSE | 30 | | 40% | - | - |
| | | | | | | ESE | 50 | 40% | | - | - |

**Course Description:**

Processing huge datasets is highly computation intensive. Parallel computing has been fruitfully employed in numerous application domains to process large datasets and handle other time-consuming operations of interest. This course provides elementary introduction to parallel algorithms and design. This course's purpose is to aware learners about parallel architecture, parallel algorithm design steps, performance analysis and parallelization of different algorithms for new applications. In this course more advanced techniques for parallel programming – GPGPU computing is introduced. This course introduces OpenMP, CUDA C/C++, etc. as programming language to implement different parallel algorithms.

**Course Learning Outcomes:**

Upon successful completion of the course students should be able to:

- Analyze the role of parallel architecture in parallel algorithms design.
- Use different parallel programming languages on multi-core and many-core architecture systems.
- Design parallel algorithms and implement it for different applications.
- Compare different Parallel algorithms from various application domains for performance analysis.

**Prerequisites:**

- Applied Algorithms, C/C++Programming and Mathematics & Statistics.

# SYLLABUS

## SECTION – I

| Unit 1: Parallel Algorithm Design | 5 hrs |
|---|---|
| Overview of parallel architecture, Parallel Application Case Studies, The Parallelization Process, Steps in the Process, Parallelizing Computation versus Data, Goals of the Parallelization Process, Parallelization Process Example. | |

| Unit 2: Analytical Modeling of Parallel Programs | 5 hrs |
|---|---|
| Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost-Optimal Execution Time, Asymptotic Analysis of Parallel Programs. | |

| Unit 3: Shared Address Space Programming : OpenMP | 8hrs |
|---|---|
| Threads, OpenMP Overview, The OpenMP model, Writing OpenMP programs, Creating Threads, Data-sharing attributes, Worksharing constructs, Synchronizations, Task Parallelism in OpenMP, Miscellaneous points. | |

## SECTION – II

| Unit 4: Combinatorial Search and Parallel Algorithms Applications | 5 hrs |
|---|---|
| Divide & conquer, Branch & bound, parallel branch & bound algorithm, Parallel Algorithms Applications: Dense Matrix Algorithms, Sorting, Dynamic Programming, Searching Algorithms for Discrete Optimization Problems. | |

| Unit 5: Introduction to GPU Computing and CUDA | 6 hrs |
|---|---|
| Introduction to GPU Computing and CUDA: CUDA Data Parallelism Model, CUDA Program Structure, Device Memories and Data Transfer, Kernel Functions and Threading. CUDA Threads: CUDA Thread Organization, Using blockIdx and threadIdx, Synchronization and Transparent Scalability, Thread Assignment, Thread Scheduling and Latency Tolerance. | |
| **Unit 6: CUDA Memories** | **7 hrs** |
| Importance of Memory Access Efficiency, Memory Types, Reducing Global Memory Traffic. Performance Considerations: More on Thread Execution, Global Memory Bandwidth, Dynamic Partitioning of SM Resources, Data Pre-fetching, Instruction Mix, Thread Granularity, Measured Performance and Summary. Floating Point Considerations: Floating-Point Format, Normalized Representation of M, Excess Encoding of E, Re-presentable Numbers, Special Bit Patterns and Precision, Arithmetic Accuracy and Rounding, Algorithm Considerations. Parallel Pattern: Convolutions, Prefix Sum, Sparse Matrix Computation. | |

**References**

1. Parallel Computer Architecture - A Hardware / Software Approach - David Culler, Jaswinder Pal Singh, Anoop Gupta, Publisher: Morgan Kaufmann, 2000.
2. Introduction to Parallel Computing, 2/E, Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, Publisher: Addison-Wesley – 2003.
3. Parallel Computing - Theory and Practice, 2nd Edition by Michel Queen, Publisher: Tata McGraw Hill-2002.
4. Programming Massively Parallel Processors, 2nd Edition by David Kirk and Wen-mei Hwu, Publisher: Morgan Kaufmann, 2012.
5. http://developer.nvidia.com/cuda
6. An introduction to Parallel Algorithms by J.A. Joseph, Publisher: Addison – Wesley 1992
7. Scalable Parallel Computing: Technology, Architecture, Programming, by Kai Hwang and Zhiwei Xu, Publisher: McGraw Hill 1998.
8. Principles of Parallel Programming by Calvin Lin, University of Texas, Austin Larry Snyder, University of Washington, Publisher: Addison-Wesley- 2009.

## Semester II

## CSE5061: Big Data Analytics

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5061 | **Big Data Analytics** | 3 | - | - | 3 | ISE | 20 | | | - | - |
| | | | | | | MSE | 30 | | 40 % | - | - |
| | | | | | | ESE | 50 | 40 % | | - | - |

**Course Description:**

- The course helps to study various Data mining issues, metrics from DB perspective.
- To study the techniques for statistical measurement.
- It aims to escalate the terminologies under different algorithms for classification & clustering.
- Understand big data for business intelligence

**Course Learning Outcomes:**

On completion of the subject the student should be able to:

1. Define various terms & terminologies for mining under DB.
2. Analyze – how does each of the Statistical technique works with particular application.
3. Justify – the usage of various Classification/Clustering algorithms on provided huge data.
4. Apply Knowledge to build – Association based rules technique for real world case studies.
5. Experiment the advancement in mining techniques/algorithms for wide variety of areas.
6. Learn business case studies for big data analytics
7. Understand No SQL big data management
8. Manage Big data without SQL

# SYLLABUS

## SECTION – I

| **Unit 1: Fundamentals of Data Mining and Mining Techniques** | **8 hrs** |
|---|---|
| Basic Data Mining Tasks, Data Mining Issues, Data Mining Metrics, Data Mining from a Database Perspective, A Statistical Perspective on Data Mining, Similarity Measures, Decision Trees | |

| **Unit 2: Classification** | **6 hrs** |
|---|---|
| Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms, Neural Network-Based Algorithms, Rule-Based Algorithms, Combining Techniques | |

| **Unit 3: Clustering** | **6 hrs** |
|---|---|
| Similarity and Distance Measures, Hierarchical Algorithms, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes. | |

## SECTION - II

| **Unit 4: Association Rules and Advanced Techniques** | **8 hrs** |
|---|---|
| Basic Algorithms, Parallel and Distributed Algorithms, Incremental Rules, Web Mining, Spatial Mining, Temporal Mining. | |

| **Unit 5: Understanding Big-Data** | **7 hrs** |
|---|---|
| What is big data – why big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine advertising and big data – big data technologies – cloud and big data – mobile business intelligence –Crowd sourcing analytics – inter and trans firewall analytic | |

| **Unit 6: No SQL-Data Base Management** | **7 hrs** |
|---|---|
| Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication. Consistancy-relaxing consistency --version stamps—MapReduce – p artitioning and combining -- Composing Map- Reduce Calculations. | |

**References**

1. M. H. Dunham. Data Mining: Introductory and Advanced Topics. Pearson Education. 2001.
2. J. Han and M. Kamber. Data Mining: Concepts and Techniques. Morgan Kaufman. 2001.
3. I. H. Witten and E. Frank. Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann.2000.
4. D. Hand, H. Mannila and P. Smyth. Principles of Data Mining. Prentice-Hall. 2001.

## Semester II
## CSE5081: Software Architecture (Program Elective-II)

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) |
| | | | | | | | Max | Min for Passing | | Max / Min for Passing |
| CSE5081 | (Program Elective-II) Software Architecture | 3 | - | - | 3 | ISE | 20 | | | - / - |
| | | | | | | MSE | 30 | | 40 % | - / - |
| | | | | | | ESE | 50 | 40 % | | - / - |

**Course Description:**

This course covers software architecture and quality attributes, in particular techniques for developing reliable and flexible systems: design patterns, frameworks. Also course is focused on applied architecture including cloud, decentralized, service oriented architecture and web services.

**Course Learning Outcomes:**

On successful completion of this course, students should be able to:

1. Design and develop software architecture for large scale software systems.
2. Recognize major software architectural styles, design patterns, and frameworks.
3. Describe a software architecture using various documentation approaches and architectural description languages.
4. Develop architectural alternatives for a problem and select among them.
5. Use well-understood paradigms for designing new systems.

**Prerequisites:**

- Required knowledge in software development
- Good knowledge of Object oriented programming

# SYLLABUS

## SECTION – I

| **Unit 1: Introduction to Software Architecture** | **4 hrs** |
|---|---|
| Software Architecture , Foundations of Software Architecture , Software architecture in the context of the overall software life cycle, Architectural Styles, CASE study of Architectures | |

| **Unit 2: Modeling** | **8 hrs** |
|---|---|
| Modeling concepts, Views and viewpoints, Early Architectural Description Language (ADL), Domain and style specific ADLs. | |

| **Unit 3: Analysis: Static, Dynamic and Scenario** | **4 hrs** |
|---|---|
| Based Analysis. Architectural Trade-off, Analysis Method. | |

## SECTION – II

| **Unit 4: Introduction to Design Patterns** | **6 hrs** |
|---|---|
| Structural Patterns, Patterns for Organization of Work, Access Control Patterns, Management Patterns, Communication Patterns | |

| **Unit 5: Architecture Pattern** | **7 hrs** |
|---|---|
| Structural Patterns (Layers, Pipe& Filter, Blackboard), Patterns for Distribution (Broker), Patterns for Interactive Systems (MVC, Presentation-Abstraction-Control), Adaptable Systems (Microkernel, Reflection), Frameworks and Patterns. | |

| **Unit 6: Applied Architecture and styles** | **7 hrs** |
|---|---|
| Network architecture (Cloud), Decentralized architecture (Grid), Service oriented Architecture and Web Services, Architecture for specific Domains (Wireless network). | |

**References**

1. R. N. Taylor, N. Medvidovic, and E. M. Dashofy. *Software Architecture: Foundations,Theory, and Practice*, John Wiley & Sons, 2009.
2. Pattern-Oriented Software Architecture by Frank Buschmann, Hans Rohnert, Kevin Henney, Douglas C. Schmidt, Publisher: Wiley; Volume 1 (2004).
3. Design Patterns: Elements of Reusable Object-Oriented Software (Addison-Wesley Professional Computing Series) by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides Publisher: Addison-Wesley Professional; 1st edition (1995)
4. Software Architecture in Practice by Len Bass, Paul Clements, Rick Kazman, Pearson.
5. The art of Software Architecture by Stephen T. Albin

## Semester II

## CSE5101: Intellectual Property Rights & Cyber Laws (Program Elective-II)

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5101 | (Program Elective-II) Intellectual Property Rights & Cyber Laws | 3 | - | - | 3 | ISE | 20 | | | - | - |
| | | | | | | MSE | 30 | | 40 % | - | - |
| | | | | | | ESE | 50 | 40 % | | - | - |

**Course Description:**

This course provides elementary introduction about intellectual property rights and cyber laws. This course's purpose is aware students about IPR and copyright issues as well as Cyber laws. This course introduces laws related with patents, copyrights, trademarks, design and Information Technology Act 2000. as programming language to implement different parallel algorithms. IPR and Cyber law is less a distinct field of law in the way that property or contracts are as it is an intersection of many legal fields, including intellectual property, privacy, freedom of expression, and jurisdiction. In essence, it is an attempt to integrate the challenges presented by human activity on the Internet with legacy system of laws applicable to the physical world.

**Course Learning Outcomes:**

Upon successful completion of the course students should be able to:

- Understand Object and Scope of IPR, Law of Patents, Copyright &Trademarks and IT Act 2000.
- Discuss the IPR concepts.
- Identify the need of the law for Patents, Copyright, and Trademarks. and E-Governance based on IT Act 2000 & its amendments.
- Identify the need of the law for E-Governance based on IT Act 2000 & its amendments.

**Prerequisites:**

- Information Security

# SYLLABUS
## SECTION – I

| **Unit 1: Intellectual Property Rights-Concepts and Evolution** | **4 hrs** |
|---|---|
| Introduction to Intellectual Property Rights, Evolution of Intellectual Property Laws, Standards and Concepts in Intellectual Property, Conventions and Treaties Relating to Global Administration of Intellectual Property Rights, Protection and Classification Regional Conventions and Treaties, Organization, Jurisdiction enforcement and Administration of IPRs, IPRs and Information Technology IPRs and Bio- technology, IPRs and Traditional Knowledge, Management of Intellectual Property Rights, Law of Intellectual Property and Ethical Issues, Knowledge Driven Economy and IPR, Intellectual Property Rights in India and abroad. | |

| **Unit 2: Law of Patents, Copyright and Trademarks** | **4 hrs** |
|---|---|
| Introduction, Evolution of patent Law, Scope and Purpose, Classification of Patents, Patent Law in India: Patent Act of 1970, The Patents (Amendments) Act, 2002, Patent Office and Authorities, Grant of Patent, Right and Obligation of a Patentee, Infringement of Patents, Offenses and penalties, Patents and other commercial Law, Patents – International Law, Patents Law- Emerging Trends, Social Implication of Patents.<br>Introduction to Copyrights as forms of Intellectual Property, Copyright Law in India (Copyright Act of 1957) - meaning, Form of Copyright and Ownership Assignment/License, Registration and terms of Copyright, Copyright infringement , Offences, Remedies and Enforcement, Broad casting Organization and performers, Copyright – International Law, Introduction to trademarks, Trademarks – forms of Intellectual Property, Law of trade Marks in India (trademark act of 1999)-meaning, registration and Authorities, Right conferred by Registration and use of Trademarks, Infringement of Trademarks and passing off, Offences, remedies and enforcement, Trademarks –International Law | |

| **Unit 3: Law of Designs, geographical Indications and other Intellectual Property** | **4 hrs** |
|---|---|
| Introduction to designs – Industrial Designs, Design Laws in India: Designs Act of 2000, Registration of Design, Owners Rights, Piracy of Designs, Offence, Remedies and Enforcement, Designs- International Law, Introduction to Geographical Indication, Law of Geographical Indication in India: Geographical Indication of Goods (Registration and Protection) Act, 1999, Register of Geographical Indication, Infringement of Registered Geographical Indication Offence, Remedies and Enforcement, The Semiconductor Integrated Circuit Lay Out design Act, 2000, The protection of Plant varieties and Farmers rights Act 2001, Law Relating to Diversity | |

**SECTION – II**

| **Unit 4: Introduction to Cyber Law** | **6 hrs** |
|---|---|
| Evolution of Computer Technology, Emergence of Cyberspace, Cyber Jurisprudence, Jurisprudence and Law, Doctrinal Approach, Consensual Approach, Real Approach, Cyber Ethics, Cyber- Jurisdiction, Hierarchy of Courts, Civil and Criminal Jurisdictions, Cyberspace – Web space (WWW), Web Hosting and Web Development Agreements (specimen), Domain Names, Internet as a Tool for Global Access | |

| **Unit 5: Cyber law issues and related legislation** | **9 hrs** |
|---|---|
| Patent Laws, Trademark law, Copyright, Software –copyright or patented, Domain Name and Copyright disputes, Electronic Database and its Protection, IT Act and Civil procedure Code, IT Act and Criminal procedure Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Section of Indian penal Code, Relevant Section of Reserve Bank of India Act, Law Relating to Employees and Internet, Alternative Dispute resolution, Online Dispute Resolution (ODR) | |

| **Unit 6: Information Technology Act, 2000** | **9 hrs** |
|---|---|
| Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptography, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying authorities, Cyber Crime and Offences, Network Service Provider Liability, Cyber Regulation Appellate tribunal, Penalties and Adjudication | |

## References


- Law and practice of intellectual property in India by Vikas Vashishth
- Intellectual property by A. Kalank
- Intellectual property- patents, copyrights, trademarks and allied rights by Cornish W R
- Patents ,copyrights, trademarks and design by B L Wadhera
- Intellectual property law by P Narayana
- Patents ,copyrights, trademarks and design by Rajeev Jain
- Introduction to Computer Law, D. Bainbridge, 5th Edition, Pearson Education, 2004.
- Cyber Law: The Indian Perspective, P. Duggal, Saakshar Law Publications, 2005.
- Cyber Law in India by Farooq Ahmad – Pioneer Books
- Information Technology Law and Practice by Vakul Sharma – Universal Law Publishing Co. Pvt. Ltd.

## Semester II

## IET522: Probability and Statistics for Engineers

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| IET522 | Advanced engineering Mathematics | 3 | - | - | 3 | ISE | 20 | | | - | - |
| | | | | | | MSE | 30 | | 40 % | - | - |
| | | | | | | ESE | 50 | 40 % | | - | - |

**Course Description:**

Probability and statistics is probably the most commonly needed stream of Mathematical Statistics for engineering and social sciences. As engineers and technocrats are the ones who are supposed to seek technological solutions to real life problems by applying their domain discipline, they need an interface which would model the real life problem into a typically and formally defined problem for which they can choose appropriate technological tool. This interface is nothing but logical arrangement of problem by identifying the characteristic behavior of the variables in the problem. As such problems are outwardly noticed or figure out in the form of data. An engineer or technologist must be conversant with the common trends of interpreting the data in terms of variable/s, classifying it, describing it meaningfully and analyzing it for further investigations for applying technological tools. This whole exercise heavily relies on some statistical tools.

This Course introduces such tools and the methodologies of investigating the data to provide meaningful description of behavior of the variate/s in the available data. Since this is a commonly occurring phenomenon in all branches of engineering and technology; students of every branch should be conversant with these practices.

**Course Learning Outcomes:**

Course Learning Outcomes: After successful completion of this Course, the students should be able to

- Use statistical methodology and tools in the engineering problem-solving process.
- Compute and interpret descriptive statistics using numerical techniques.
- Explain and apply the basic concepts of probability, random variables, probability distribution, and joint probability distribution.

- Compute point estimation of parameters, explain sampling distributions, and understand the central limit theorem.
- Construct confidence intervals on parameters for a single sample.

# SYLLABUS

## SECTION – I

| **UNIT 1: Introduction to Data Analysis and Probability** | **8 hrs** |
|---|---|
| Overview: Statistical Inference, Samples, Population; Measures of Location and Measures of Variability, Graphical Methods and Data Description; Sample Space and Events, Probability of an Event, Additive Rules, Conditional probability, Multiplicative Rules, Baye's theorem. | |

| **UNIT 2: Random Variables and Discrete Probability Distributions** | **8 hrs** |
|---|---|
| Random variable – Discrete and continuous, Discrete Probability Distributions, Joint Probability Distributions, Discrete Uniform Distribution, Binomial and Multinomial Distributions, Hypergeometric Distribution, Negative Binomial and Geometric Distributions, Poisson Distribution and Poison Process. | |

| **UNIT 3: Continuous Probability Distributions** | **6 hrs** |
|---|---|
| Continuous Uniform Distribution, Normal Distribution, Gamma and Exponential Distributions, Chi-Squared Distribution, Lognormal Distribution | |

## SECTION - II

| **UNIT 4: Fundamental Sampling Distributions and Tests of Hypotheses** | **8 hrs** |
|---|---|
| Random Sampling, Sampling Distributions, Sampling Distribution of Means and $S^2$, $t$-Distribution, $F$-Distribution, Statistical Inference, Tests of Hypotheses (Scope to be Fixed by Course Instructors) | |

| **UNIT 5: Simple Linear Regression and Correlation** | **6 hrs** |
|---|---|
| Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Properties of Least Squares Estimators, Inferences Concerning the Regression Coefficients, Prediction, Choice of a Regression Model, Analysis-of-Variance Approach, Correlation. | |

| **UNIT 6: Program Specific Mathematics-Based Unit** | **6 hrs** |
|---|---|
| Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – sharding – master-slave replication – peer-peer replication – sharding and replication. Consistancy-relaxing consistency --version stamps—MapReduce – p artitioning and combining -- Composing Map- Reduce Calculations. | |

**Text Book:** Probability and Statistics for Engineers and Scientists, by Walpole, Myers, Keying Ye; Pearson Education India, 8th Edition, 2008

**Reference Books:**

1. Probability & Statistics by D.K. Murugesan & P.Guru Swamy, Anuradha Publications
2. Probability & Statistics for Engineers by G.S.S.Bhisma Rao, Scitech Publications
3. Probability & Statistics by T.K.V.Iyengar & B.Krishna Gandhi & Others, S.Chand
4. Probability & Statistics by William Mendenhall & Others, Cengage Publications

## Semester II

## CSE5161: Web Development Laboratory-II

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | Max | Min for Passing |
| CSE5161 | Web Development Laboratory-II | 2 | - | 2 | 3 | ISE | - | - | 50 | 50% |
| | | | | | | ESE | - | - | 50 | |

**Course Description:**

Server-side scripting is a technique used in web development which involves employing scripts on a web server which produce a response customized for each user's (client's) request to the website. Server-side scripting is often used to provide a customized interface for the user. The course covers following server side technologies used for web application developments: ASP.Net, Servlets and JSP.

**Course Learning Outcomes:**

1. Design dynamic web applications
2. Develop dynamic web application
3. Deploy code on web application server to process User requests.
4. Develop with the Struts framework
5. Integrate server side programs with enterprise data sources.

**Prerequisites:**

- Acquaintance with the Computers and Internet.
- Knowledge of Java and C# programming.

# SYLLABUS

## SECTION – I

| **Unit 1: ASP.NET Server Controls and Master Pages** | **(4)** |
|---|---|
| Important facts about ASP.NET, The Code Model, Web Project. Common Server Controls, Specialized Server Controls, Validation Controls, Site Navigation Controls.Using Master Pages-Creating master pages, Creating content pages, attaching master pages to content pages, Creating nested master pages. | |

| **Unit 2: ASP.NET State Management and ADO.NET** | **(5)** |
|---|---|
| Client Side State management-View state, Query string, Hidden field, Cookies; Using Server Side State management-Application state, Session State. ADO.NET Architecture, The Connection Class, The Command and DataReader Class | |

| **Unit 3: ASP.NET Ajax** | **(3)** |
|---|---|
| Introduction, Sever Callbacks, ASP.NET Ajax Server Controls, Deeper into the Client Libraries, Control Extenders | |

## SECTION – II

| **Unit 4: Servlet** | **(4)** |
|---|---|
| Introduction to Servlet , Why Servlet?, Servlet Life Cycle, MVC Design Pattern, Java Beans, Creating and deploying Servlet, Writing Service Methods, Retrieving form data, Maintaining Client State, Inter Servlet Communication. Session Tracking: Cookies, URL Rewriting, Hidden form field, HTTPSession API | |

| **Unit 5: Java Server Pages** | **(4)** |
|---|---|
| Introduction to JSP, Static and Dynamic web pages, Why JSP Pages are dynamic? CRUD Operation with JSP, JSP tags: Declaration tag, Expression tag, Directive Tag, Scriptlet tag, Action tag, JSTL. | |

| **Unit 6: Struts and Hibernate Framework** | **(4)** |
|---|---|
| Struts Architecture, How Struts Works?, Introduction to the Struts, Controller, Introduction to the Struts Action Class, Using Struts ActionFrom Class, Using Struts HTML Tags, Introduction to Struts Validator Framework. Hibernate | |

**Text Books:**

1. Marty Hall, Larry Brown, YaakorChaikin, "Core Servlets and Java Server Pages", Pearson.
2. Sharanam Shah, Vaishali Shah, "Struct 2 with Hibernate 3 project for Beginners", Shroff publishers.
3. Istran Novak, Anders Velvart, Adam Granicz, "Visual Studio 2010 and .NET 4", Wiley.\

**Reference Books:**

1. Paul J. Perane, Venkata S. R. Krishna R. Chagant, "Building Java Enterprise Systems with J2EE", Techmedia
2. Kevin Mukhar and James L. Weaver, "Beginning J2EE 1.4", Apress.
3. Tony Northrup, Mike Snell,"Web Applications Development with Microsoft .NET Framework 4", PHI.
4. Mathew MacDonald, "ASP.NET: The Complete Reference", McGraw-Hill.

## Semester II

## CSE5181: High Performance Computing Lab

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5181 | High Performance Computing Lab | - | - | 2 | 1 | ISE | - | - | - | 50 | 50% |
| | | | | | | ESE | - | - | | 50 | 50% |

**Course Description:**

The principle objective of this course is to study different Parallel programming models and develop applications which demands huge computation power.

Student should use OpenMP, CUDA C/C++, etc. as programming language to implement different parallel algorithms & applications. This course focuses on the implementation of basic and advanced parallel algorithms for different applications. The algorithms will be analyzed with different performance metrics.

**Course Learning Outcomes:**

Upon successful completion of the course students should be able to:

On completion of this course the student will be able to:

1. Use different parallel programming languages on multi-core and many-core architecture systems.
2. Explore different parallel algorithms to solve real world problems.
3. Compare different Parallel algorithms from various application domains for performance analysis.

**Prerequisites:**

- Applied Algorithms, C/C++Programming and Mathematics & Statistics.

## SYLLABUS

The lab work should consist of 4-6 practical assignments based on OpenMP/CUDA C, etc. The practical assignments are to be given and evaluated by the respective course coordinator. A journal is to be prepared by individual student and duly signed by the respective teacher to be submitted to the department at the end of the semester.

## Semester II

## CSE5201:Mini-Project

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| CSE5201 | Mini-Project | - | - | 2 | 2 | ISE | - | - | - | 100 | 50 % |

**Course Description:**

The principal objective of this course is to implement a small research problem using any suitable technique. It focus is on study and presentation of experimental details and result.

**Course Learning Outcomes:**

On completion of this subject the student will be able to:

1. Identify and formulate research problem.
2. Identify and implement suitable techniques for research problems.
3. Analyze the results with appropriate tools and techniques available.
4. Present the finding of experimental details and result.

**Prerequisites:**

- Familiarity with the programming language and basics of computer science and engineering subjects.

**SYLLABUS**

It is a course to be completed under the guidance of faculty called as Supervisor. It is expected that the student should implement a project based on research problem. Preference should be given to the work carried out during seminar in semester-I. Student should present the report to DPGC and justify about the innovativeness, applicability, relevance and significance of the work. Student shall submit report as per the prescribed format in 02 copies to department.

## Semester II

## IEO523: Proficiency in Technical Communication

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | Max | Min for Passing |
| IEO523 | Proficiency in Technical Communication | - | - | 2 | 1 | ISE | - | - | 50 | 50% |

**Course Objective:**

- To demonstrate knowledge and skills to formulate various types of business and technical communication.
- To analyze rhetorical aspects of audience, purpose, and context of technical information to effectively communicate through written, oral, and visual media.

**Learning Outcomes:**

After successful completion of this course students should be able to:

- Prepare documents that are structurally and technically appropriate.
- Enhance writing skills with clarity, conciseness, coherence, cohesion, and emphasis.
- Develop strategies for any Communication to address diverse forums.
- Learn to Listen actively and Efficiently
- Enhance Inter-personnel interaction & interviewing techniques.

## Syllabus

| **Unit 1:** | **2 hrs** |
|---|---|
| **Language for Technical Purpose and Presentation Tools**:- Technical vocabulary, Sentence structures, Microsoft office, Graphical presentations | |

| **Unit 2:** | **2 hrs** |
|---|---|
| **Formal Written Communication**:- Drafting Letters, e-Mails, Memos, Notices, Circulars, Schedules. | |

| **Unit 3:** | **2 hrs** |
|---|---|
| **Project and Research Proposals**: - What's a research proposal? Essentials, Abstract, Aims, Background & significance, Design & methods, Writing a sample proposal. | |

| **Unit 4:** | **2 hrs** |
|---|---|
| **Project Reports**:- Types of reports, Planning a report, Collection & organization of information, Structure & style, Proofreading etc. Writing a sample report. | |

| **Unit 5:** | **2 hrs** |
|---|---|
| **Team Building and Working in Groups**:- Need of team, Effective teams, Group development, Roles in group, Case studies. | |

| **Unit 6:** | **2 hrs** |
|---|---|
| **Leadership Skills**:- Leadership quality and styles, Emotional intelligence, Diplomacy and Tact and effective communication, Case studies. | |

| **Unit 7:** | **2 hrs** |
|---|---|
| **Business Meetings**:- Understanding role of meetings, planning meetings, developing meeting agendas, scheduling meetings, conducting meetings effectively, Taking notes and publishing minutes and concluding meetings, action plans, Demo meetings. | |

| **Unit 8:** | **2 hrs** |
|---|---|
| **Presentation Skills**:- Preparation, Understanding audience, Use of presentation tools, Presentation, nonverbal techniques, handling questions, Demo presentations. | |

**References Books:**

1. S. Hariharan, et.al. Soft Skills; MJP Publishers, 2010.
2. John Seely, Oxford Guide to Effective Writing and Speaking; Oxford University Press, 2009.
3. Thomas N. Huckin and Leslie A. Olsen, Technical Writing and Professional Communication for Nonnative Speakers of English; Tata McGraw Hills, International Edition, 1991.
4. Jeff Butterfield,Soft Skills for Everyone,cengage Learning India Private Limited,2010.
5. L. Ann Masters & Harold R. Wallace, Personal Development for Life & Work,10e, Cengage Learning India Private Limited,2011.

## Semester II

### CSE5221: Comprehensive Viva- Voce

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks) | | Practical (Marks) | |
| | | | | | | | Max | Min % for Passing | Max | Min % for Passing |
| CSE5221 | Comprehensive Viva Voce | - | - | - | 1 | ESE | - | - | 100 | 50 |

**Course Outcomes:**

**At the end of the course the students will be able to: -**

1. Comprehend the knowledge gained in the course work
2. Infer fundamental elements of subjects in computer science engineering.
3. Demonstrate the ability in problem solving and Critical thinking.

**Course Description:**

Comprehensive Viva-Voce is conducted at the end of the Semester II. The students have to prepare three courses, one from Semester I and two courses from Semester II. The list of courses will be provided by Head of the Programme. This will test the student's learning and understanding during the course of their post graduate programme. The main objective of this course is to prepare the students to face technical interview both at the academic and the industrial sector.

The Comprehensive Viva-Voce will be conducted by the external and internal examiner jointly and their appointments will be made by COE along with two Faculty members of the concerned programme. The in-depth knowledge, preparation and subjects understanding will be assessed by the Examiners. The Comprehensive Viva Voce is evaluated for 100 marks by the Committee.

After successful passing in the exam, students will earn 1(One) credit. There are no internal marks.

## IEO5101: Advance Networks
**(Open Elective-II)**

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Theory (Marks %) | | | Practical (Marks %) | |
| | | | | | | | Max | Min for Passing | | Max | Min for Passing |
| IEO5101 | **Advance Networks** (Open Elective -Institute Level) | 3 | - | - | 3 | ISE | 20% | | | - | - |
| | | | | | | MSE | 30% | | 40% | - | - |
| | | | | | | ESE | 50% | 40% | | - | - |

**Course Description:**

Communication is one of the fundamental applications of computer systems. Wireless technologies are becoming popular in these days. This course will cover the fundamental aspects of wireless networks, with emphasis on current and next-generation wireless networks providing insight and knowledge about architectures and protocols for Mobile and wireless communication.

The course discusses about Wireless LAN, Emerging Wireless Technology, and Technologies for Mobile communication. It also focuses on fundamental of Wireless ad-hoc network, its routing protocols and Wireless Sensor Network.

**Course Learning Outcomes:**

At the end of course student should be able to,

- Comprehend the concepts of Wireless LAN.
- Differentiate between the technologies and protocols used in wireless and mobile communication.
- Discuss the concepts of Wireless Ad-hoc Network.
- Simulate and analyze the routing protocols used in Wireless Ad-hoc Network.
- Formulate and solve problems in Wireless Sensor Network.

**Prerequisites:**

- Basics of Computer Network.

# SYLLABUS

## SECTION – I

| **Unit 1: Wireless LAN** | **06** |
|---|---|
| Introduction, advantages, IEEE 802.11 standard, Wireless LAN Architecture, Mobility in Wireless LAN, Deploying Wireless LAN, Mobile Ad-hoc Network and Sensor Network, Wireless LAN security, Wireless Access in Vehicular Environment, Wireless Local Loop, HiperLAN, WiFi versus 3G. | |

| **Unit 2: Emerging Wireless Technology** | **06** |
|---|---|
| Introduction, Bluetooth, Radio Frequency Identification(RFID), Wireless Broadband(WIMAX),Mobile IP, Internet Protocol Version 6 (IPV6). | |

| **Unit 3: Technologies for Mobile Communication** | **06** |
|---|---|
| Global System for mobile communication (GSM), Short Message Service (SMS), General Package Radio Service (GPRS), Wireless Application Protocol (WAP), CDMA and 3G. | |

## SECTION – II

| **Unit 4: Ad-hoc Wireless Network** | **06** |
|---|---|
| Introduction to Ad-hoc Wireless Networks, Overview, Characteristics, Applications, Issues in Ad Hoc wireless networks, MAC Protocols for ad hoc wireless networks: Introduction, Issues in designing MAC protocol, Design goals of MAC protocol, Classification of MAC protocols, Contention based protocols. | |

| **Unit 5: Routing Protocol in Ad-hoc Wireless Network** | **06** |
|---|---|
| Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols: Table driven, on-demand Hybrid routing protocols, Issues in designing a multicast routing protocol, Operation of multicast routing protocols, An architecture reference model for multicast routing protocols, Classification of multicast routing protocols, Tree-based, Mesh-based multicast routing protocols. | |

| **Unit 6: Wireless Sensor Network** | **06** |
|---|---|
| Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering , MAC Protocols for Sensor Networks, Location Discovery, Quality of Sensor Network ,Other Issues: Energy Efficient Design, Synchronization, Transport Layer Issues, Security , Real Time Communication. | |

**References:**

**Text Book:-**

1) Asoke K Talukder,Hasan Ahmed , Roopa R. Yavagal , "Mobile Computing : Technology, Applications and service creation" ,2nd edition,Mc Graw Hill publication
2) Yi-Bing and Imrich Chlamtac, "Wireless and Mobile Networks Architectures", John Wiley & Sons, 2001
3) Ad Hoc wireless Networks – Architecture and Protocols by C.S.R.Murthy & B.S. Manoj, Pearson Education

**Reference Books:-**

1. Wireless communication and Networks by William Stallings , 2nd edition , Pearson Education
2. Imielinski T. and Korth H.F., "Mobile Computing", Kluwer Academic Publishers, 1996.
3. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "Ad Hoc & Sensor Networks:Theory and Applications", World Scientific, 2007.
4. Toh C. K., "Ad Hoc Mobile Wireless Networks Protocols and Systems", Prentice Hall, PTR, 2001.

*Kasegaon Education Society's*
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Date: - 12 July 2016

To,

1. Controller of Examination
2. Central Library in charge

**Sub – Copy of Structure and Syllabus of M.Tech. for Semester III & IV to be implemented from 2016-17.**

Sir/Madam

Sending herewith, the copy of Structure and Syllabus of M.Tech. for Semester III & IV to be implemented from 2016-17.

Thanking you

Dr.M.T. Telsang
Dean Academics

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**Second Year M. Tech.**

## Semester III

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) Max | (Marks %) Min for passing |
| CSE6011 | Field /Professional Training | - | - | - | 2 | ISE | 2 | 100 | 50% |
| CSE6051 | Dissertation Stage I | - | - | 5* | 4 | ISE | 4 | 100 | 50% |
| CSE6071 | Dissertation Stage II | | | | 10 | ISE | 4 | 100 | 50% |
| CSE6091 | | | | | | ESE | 6 | 100 | 50% |
| **Total Credits** | | | | | **16** | | | | |
| **Total Contact Hours/Week** | | | | | **5* hrs** | | | | |

*Average contact hours/week/student.

## Semester IV

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) Max | (Marks %) Min for passing |
| CSE6021 | Dissertation Stage III | - | - | 5* | 8 | ISE | 8 | 100 | 50% |
| CSE6041 | Dissertation Stage IV | | | | 10 | ISE | 4 | 100 | 50% |
| CSE6061 | | | | | | ESE | 6 | 100 | 50% |
| **Total Credits** | | | | | **18** | | | | |
| **Total Contact Hours/Week** | | | | | **5* hrs** | | | | |

* Average contact hours/week/student.

**Grand Total of Credits: 24+24+16+18 = 82**

ISE: In Semester Examination
MSE: Mid Semester Examination
ESE: End Semester Examination

To be implemented from 2016-17

# Semester -III
# CSE 6011 Field /Professional Training

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) | |
| | | | | | | | | Max | Min for passing |
| CSE6011 | Field /Professional Training | - | - | - | 2 | ISE | 2 | 100 | 50% |

In the field training work, the student is expected to get training in the industry, related to subject specialization for duration of 15 days (minimum) for at least 6 hrs per day. Student should write a report on the field training and submit to department for ISE evaluation at the beginning of third semester. Student should include the certificate from the company regarding satisfactory completion of the filed training.

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# Semester -III
# CSE 6051 Dissertation Stage-I

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) Max | (Marks %) Min for passing |
| CSE6051 | Dissertation Stage I | - | - | - | 4 | ISE | 2 4 | 100 | 50% |

A dissertation is a scientific study or investigation meant to address a specific problem and aimed at generating an applicable solution. It provides the opportunity for students to demonstrate independence and originality of the work, to plan and implement dissertation work methodically and to put into practice some of the techniques' student have been learned throughout the course.

It is expected that student should develop a solution for a problem, which does not already exist, or enhance some existing application or method to improve its functionality, performance, etc. Interdisciplinary Dissertation proposals and innovative dissertations are encouraged and more appreciable. A straightforward implementation of dissertation work is acceptable, but it is good to consider dissertation deliverable as a fully-functioning 'product' or publication in a reputed journal.

**Dissertation Phase-I**

It consists of

a) Synopsis Preparation
b) Synopsis approval by DPGC committee

**Synopsis Preparation:**

Postgraduate student should decide on the dissertation topic in consultation with its supervisor and come out with a synopsis of dissertation work, in July/August of an academic year. The Synopsis shall consist of three chapters - Introduction, Literature Review and Methodology with expected deliverables.

It is expected that student should have in-depth understanding of the selected problem, knowledge of probable solutions to the same problem and expected outcomes from the dissertation work.

The synopsis shall consist of following points

- Title
- Introduction
- Literature Survey
- Objectives
- Methodology
- Activity chart
- References

The title should be brief, accurate, descriptive, comprehensive and clearly indicate the subject for the investigation.

The introduction part should include

1. Area of the work
2. Importance of the work

Literature review should

1. Examine the most current studies on the topic and presenting the significant aspects of these studies.
2. Compare different authors' views about the issue
3. Summarize the literature in terms of a knowledge gap identification e.g. performance improvement of the existing system, functionality improvement of the existing, proposing an entirely new approach, etc.

It should be followed by the Problem statement formulated based on identified gap and objectives of the study

Methodology shall include information such as techniques, sample size, target populations, equipment's, data analysis, etc. and explain why proposed methodology is most suitable to solve the undertaken problem.

It should be followed by activity chart mentioning probable duration for completion of various activities to be undertaken during dissertation work and appropriate list of references. The references should be from reputed journals such IEEE, Sciencedirect, Elsevier etc.

**Synopsis approval and evaluation by DPGC Committee:**

The student should submit the synopsis duly signed by supervisor in the prescribed format to the department office.

The DPGC committee is advised to conduct the Synopsis Presentation for the students of the program within the stipulated period and give approval to the synopsis with the evaluation score.

The committee is advised to find the enough complexity in the dissertation work, and all committee members should remain present at the time of the presentation.

The objective of the presentation is to find quality of work undertaken by the student, student's understanding about basic concepts required to carry out the work, scope of the work , correctness of the methodology, consistency of proposed work with dissertations works of other students and student's ability to communicate his or her ideas and work.

The committee can suggest modifications in the synopsis if it does not fulfill above-mentioned requirements. The student should prepare a modified synopsis by incorporating suggestions given by members and give presentation again.

The supervisor must ensure that student have incorporated all suggestions.

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# Semester -III

## CSE 6071 Dissertation Stage-II

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) | |
| | | | | | | | | Max | Min for passing |
| CSE6071 | Dissertation Stage II | - | - | 5 | 4 | ISE | 4 | 100 | 50% |

## CSE 6091 Dissertation Stage-II

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) | |
| | | | | | | | | Max | Min for passing |
| CSE6091 | Dissertation Stage II | - | - | 5 | 6 | ESE | 6 | 100 | 50% |

After synopsis approval, it is expected that student should start working on the selected problem as per activity chart given in the synopsis. It is expected that at least 40% dissertation work should be completed by a student in this phase.

**Evaluation of Dissertation Phase-II:**

Evaluation (ISE) of Dissertation Phase-II shall be carried before the end of the semester-III and shall be jointly evaluated by Supervisor and Internal-examiner appointed by DPGC committee. The student should give presentation / demonstration of the work done. The examiners shall look at student's progress and quality of the work done. The suggestions shall be given to the student, if required. The student should keep a record of these suggestions and incorporate them in his or her work. The supervisor should ensure that suggestions given are incorporated by the student.

The End –semester examination (ESE) of Dissertation Phase-II shall be carried out by Controller-of-Examinations after the end of Semester-III. The student should give presentation and/or demonstration of completed work in front of supervisor and external examiner appointed by CoE.

# Semester -IV
# CSE 6021 Dissertation Stage-III

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) | |
| | | | | | | | | Max | Min for passing |
| CSE6021 | Dissertation Stage III | - | - | - | 8 | ISE | 8 | 100 | 50% |

In Dissertation Phase-III, it is expected that student should complete at least 70% of the dissertation work and prepare a draft of the paper for publication.

**Evaluation of Dissertation Phase-III:**

The evaluation (ISE) of Dissertation Phase-III shall be carried out in March of the academic year by Supervisor and Internal examiner appointed by DPGC. The appointed members shall look at student's progress and quality of the work done. The suggestions shall be given to the student, if required. The student should keep a record of these suggestions and incorporate them. The supervisor should ensure that suggestions given are incorporated by the student.

If student's progress is not as per expectation, the committee member shall issue a written notice to the student about probable extension.

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# Semester -IV

## CSE 6041 Dissertation Stage-IV

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) | |
| | | | | | | | | Max | Min for passing |
| CSE6041 | Dissertation Stage IV | - | - | 5 | 4 | ISE | 4 | 100 | 50% |

## CSE 6061 Dissertation Stage-II

| Course Code | Course | Teaching Scheme | | | | Evaluation Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Credits | Scheme | Credits | (Marks %) | |
| | | | | | | | | Max | Min for passing |
| CSE6061 | Dissertation Stage IV | - | - | 5 | 6 | ESE | 6 | 100 | 50% |

In Dissertation Phase-IV, it is expected that student should complete

- 100% implementation of the proposed system
- Simulation/ experimentation work on the proposed system
- Performance evaluation of the proposed system
- Comparison of the proposed system with existing systems
- Writing of the conclusion
- Preparation of a draft-copy of the dissertation report with Plagiarism report

**Evaluation of Dissertation Phase-IV:**

The DPGC committee is advised to evaluate the dissertation pre-submission presentation and/or system demonstration given by the students at the end of semester –IV within the stipulated period and give approval/modifications to the work done by the student along with the evaluation score.

The committee is advised to verify work completion as per the synopsis, and all committee members should remain present for the presentation.

The objective of the presentation/ demonstration is to understand techniques implemented by the student, student's own contribution in the development process, obtained results, comparison of results with existing systems, and deliverables of the dissertation work.

The committee can suggest modifications if it does not fulfill above-mentioned requirements in the system/ draft copy of the report. In this case, the student should modify the system in a given time span based on suggestions given by the members and give presentation again in front of committee members.

The members should ensure that student has incorporated all suggestions and gives him/her approval to submit the dissertation work for final evaluation.

**Final evaluation of Dissertation work:**

The final evaluation of the dissertation work shall be carried out by a three member committee, comprising of Chairman, External Examiner and concerned supervisor. This committee should be appointed by Controller of Examinations.

The student should give presentation and demonstration of work carried out in front of committee members. The external examiner and supervisor should evaluate student's performance based on following points

1. Justification and clarity of the problem statement and project objectives
2. Use of appropriate, applicable and justifiable methodology to solve problem undertaken
3. Reliability and validity of data collection instruments /resources used, critical data analysis and interpretation
4. Overall system design
5. Experimental Results and their comparison with existing systems
6. Critical analysis of obtained results and their interpretation and correlation with project deliverables
7. Scientific justification of conclusions
8. Self contribution of the candidate in project development irrespective of use of readymade hardware/software
9. Presentation skills

The chairman shall ensure smooth conduct of the examination.