# K.S. Rangasamy College of Technology
## (Autonomous)

## Curriculum & Syllabi

## for

## M.Tech. Data Science

## (For the batch admitted in 2024 – 2025)

## R2022

**Accredited by NAAC with 'A++' grade,**
**Approved by AICTE, Affiliated to Anna University, Chennai.**

**KSR Kalvi Nagar, Tiruchengode – 637 215.**
**Namakkal District, Tamil Nadu, India.**

Rev. No.3/w.e.f. 22.07.2024 Approved Passed in BoS Meeting held on 24/05/2024in Academic Council Meeting held on 25/05/2024

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## M.Tech - DATA SCIENCE

**VISION**

To emerge as an Information Technology knowledge hub by imparting quality education, promoting research and innovation.

**MISSION**

- To provide holistic education through curriculum update, inspired and experiential learning
- To mold the students as responsible professionals to compete with the emerging global challenges

### 1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

**PEO1:** **Core Competence**: Graduates will demonstrate their technical skills and competency in various applications through the use of Data Science

**PEO2:** **Successful Career:** Graduates will establish their knowledge by adopting Data Science technologies to solve the real world problems

**PEO3:** **Ethics and life-long learning:** Graduates will continue to advance in their career through life-long learning with a social and ethical concern

### 2. PROGRAMME OUTCOMES (POs)

**Engineering Graduates will be able to:**

**PO1:** An ability to independently carry out research /investigation and development work to solve practical problems

**PO2:** An ability to write and present a substantial technical report/document

**PO3:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

**PO4:** Create and develop computer programmes and computer-based systems in the fields of security, web design, and artificial intelligence

**PO5:** Demonstrate the impact of the professional engineering solutions in societal and environmental contexts for sustainable development.

**PO6:** Recognize the need of autonomous, lifelong learning in the context of technological change, and possess the necessary skills and readiness.

### 3. PEO / PO MAPPING

The M. Tech. Data Science Programme Outcomes leading to the achievement of the Programme Educational Objectives are summarized in the following table.

| Programme Educational Objectives | Programme Outcomes | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| PEO 1 | 3 | 3 | 2 | 3 | 2 | 3 |
| PEO 2 | 2 | 3 | 2 | 3 | 3 | 2 |
| PEO 3 | 3 | 2 | 3 | 2 | 2 | 3 |

**Contributions: 1- low, 2- medium, 3- high**



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## MAPPING – M.Tech – DATA SCIENCE

| YEAR | SEMESTER | COURSE NAME | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|---|
| Year I | I | Mathematics for Data Science | 2.4 | 2.5 | 0.8 | 2.8 | 1.2 | 2.5 |
| | | Research Methodology and IPR | 3 | 2.8 | 3 | 2.5 | 2.5 | 2.5 |
| | | Data Analytics using Python | 3 | 2.8 | 2.6 | 3 | 2.5 | 3 |
| | | Advanced Data Management | 3 | 2.6 | 3.6 | 2.6 | 2.6 | 2.6 |
| | | Machine Learning Techniques | 2.8 | 2 | 2.5 | 2.6 | 2.5 | 2.6 |
| | | Professional Elective I | | | | | | |
| | | Audit Course – I* | | | | | | |
| | | Machine Learning Laboratory | 3 | 2.5 | 2.6 | 2.8 | 2.6 | 2.6 |
| | II | Exploratory Data Analysis | 3 | 2.6 | 2.2 | 2.6 | 3 | 2.4 |
| | | Advanced Machine Learning | 2.8 | 2.8 | 2.8 | 2.4 | 2.8 | 2.8 |
| | | Business Analytics | 2 | 2 | 3 | 2.4 | 2.2 | 2.4 |
| | | Data Security and Privacy | 2 | 2 | 3 | 2.8 | 2.8 | 2.6 |
| | | Professional Elective II | | | | | | |
| | | Professional Elective III | | | | | | |
| | | Audit Course – II* | | | | | | |
| | | Term Paper and Seminar | | | | | | |
| | | Exploratory Data Analysis Laboratory | 3 | 2.6 | 2.2 | 2.6 | 2.6 | 2.8 |
| Year II | III | Deep Learning | 2 | 2 | 3 | 3 | 2 | 2 |
| | | Professional Elective IV | | | | | | |
| | | Professional Elective V | | | | | | |
| | | Professional Elective VI | | | | | | |

## K.S. RANGASAMY COLLEGE OF TECHNOLOGY

### Credit Distribution for M.Tech (Data Science) Programme – 2024 - 2025 Batch

| S. No. | Category | Credits per Semester | | | | Total Credits | Percentage % |
|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | | |
| 1. | **RM** | 03 | - | - | - | 03 | 04.17 |
| 2. | **PC** | 15 | 14 | 04 | - | 33 | 45.83 |
| 3. | **PE** | 03 | 06 | 09 | - | 18 | 25.00 |
| 4. | **CG** | - | - | 06 | 12 | 18 | 25.00 |
| 5. | **AC** | AC I | AC II | - | - | - | - |
| **Total** | | **21** | **20** | **19** | **12** | **72** | **100** |

**PC - PROFESSIONAL CORE**
**PE - PROFESSIONAL ELECTIVE**
**CG - CAREER GUIDANCE COURSES**
**AC - AUDIT COURSES**



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**PROFESSIONAL CORE (PC)**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Prerequisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 PDS 101 | Mathematics for Data Science | PC | 5 | 3 | 1 | 0 | 4 | Basic Knowledge of probability and Statistics, Data Mining |
| 2. | 60 PED 001/ 60 PDB E26 | Research Methodology and IPR | PC | 3 | 3 | 0 | 0 | 3 | Nil |
| 3. | 60 PDS 102 | Data Analytics using Python | PC | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Higher Secondary Mathematics |
| 4. | 60 PDS 103 | Advanced Data Management | PC | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Database Management System, Big Data |
| 5. | 60 PDS 104 | Machine Learning Techniques | PC | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Data Mining and its applications |
| 6. | 60 PDS 1P1 | Machine Learning Laboratory | PC | 4 | 0 | 0 | 4 | 2 | Basic Knowledge of probability and Statistics, Data Mining |
| 7. | 60 PDS 201 | Exploratory Data Analysis | PC | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Data mining and machine learning techniques |
| 8. | 60 PDS 202 | Advanced Machine Learning | PC | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Machine Learning |
| 9. | 60 PDS 203 | Business Analytics | PC | 3 | 3 | 0 | 0 | 3 | Data Mining |
| 10. | 60 PDS 204 | Data Security and Privacy | PC | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Cryptography and Network Security, Data Management |
| 11. | 60 PDS 2P2 | Exploratory Data Analysis Laboratory | PC | 4 | 0 | 0 | 4 | 2 | Data Mining, Machine Learning |
| 12. | 60 PDS 301 | Deep Learning | PC | 5 | 3 | 1 | 0 | 4 | Basic Knowledge of Probability & Statistics, Artificial Intelligence and Machine Learning |

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## PROFESSIONAL ELECTIVES (PE)
## SEMESTER I, ELECTIVE I

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Prerequisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 PDS E11 | Artificial Intelligence and Internet of Things | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Artificial Intelligence, Big Data |
| 2 | 60 PDS E12 | Soft computing and its Applications | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Neural Network, Deep Learning |
| 3. | 60 PDS E13 | Data Mining and Applications | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Neural Network, Deep Learning |
| 4. | 60 PDS E14 | Distributed Systems | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Operating Systems, Computer Networks |
| 5. | 60 PDS E15 | Software Engineering for Data Science | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Software Engineering |

## SEMESTER II, ELECTIVE II

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Prerequisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 PDS E21 | Advanced Algorithms and Optimization | PE | 3 | 3 | 0 | 0 | 3 | Data Structure, Design and Analysis of Algorithms |
| 2. | 60 PDS E22 | Intelligent Database Systems | PE | 3 | 3 | 0 | 0 | 3 | Database Systems, SQL, XML, Data Science |
| 3. | 60 PDS E23 | Natural Language Processing and Text Mining | PE | 3 | 3 | 0 | 0 | 3 | Data Mining, Machine Learning |
| 4. | 60 PDS E24 | Time Series Analysis and Forecasting | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Higher Secondary Mathematics, Python |
| 5. | 60 PDS E25 | Predictive Modeling and Data Analytics | PE | 3 | 3 | 0 | 0 | 3 | Data Mining, Machine Learning |



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**SEMESTER II, ELECTIVE III**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Prerequisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 PDS E31 | Reinforcement Learning | PE | 3 | 3 | 0 | 0 | 3 | Data Mining, Machine Learning |
| 2. | 60 PDS E32 | Recommender Systems | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Higher Secondary Mathematics, Binary operations |
| 3. | 60 PDS E33 | Big Data Security | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Cryptography and Network security, Big Data &Mathematical Logic |
| 4. | 60 PDS E34 | Blockchain in AI and IoT | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Cryptography and Network Security |
| 5. | 60 PDS E35 | Cognitive Science and Analytics | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Artificial Intelligence |

**SEMESTER III, ELECTIVE IV**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Prerequisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 PDS E41 | Pattern Recognition | PE | 3 | 3 | 0 | 0 | 3 | Data Mining, Machine Learning |
| 2. | 60 PDS E42 | IoT Architecture and Computing | PE | 3 | 3 | 0 | 0 | 3 | Embedded Systems |
| 3. | 60 PDS E43 | Advanced Web Analytics | PE | 3 | 3 | 0 | 0 | 3 | Web Technology, Data Mining, Machine Learning |
| 4. | 60 PDS E44 | Stream Processing and Analytics | PE | 3 | 3 | 0 | 0 | 3 | Data Mining, Machine Learning |
| 5. | 60 PDS E45 | Ethics for Data Science | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Ethics, Data Science |



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**SEMESTER III, ELECTIVE V**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Prerequisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 PDS E51 | Predictive Analytics for Internet of Things | PE | 3 | 3 | 0 | 0 | 3 | Internet of Things, Data Mining, Machine Learning |
| 2. | 60 PDS E52 | Data Governance and Quality | PE | 3 | 3 | 0 | 0 | 3 | Data Management |
| 3. | 60 PDS E53 | Web Analytics and Development | PE | 3 | 3 | 0 | 0 | 3 | Web Technology, Data Mining, Machine Learning |
| 4. | 60 PDS E54 | Next Generation Databases | PE | 3 | 3 | 0 | 0 | 3 | Basic Knowledge of Structured and unstructured data |
| 5. | 60 PDS E55 | GPU Computing | PE | 3 | 3 | 0 | 0 | 3 | Programming and Data Structure, Digital Logic, Computer architecture |

**SEMESTER III, ELECTIVE VI**

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Prerequisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 PDS E61 | Computer Vision | PE | 3 | 3 | 0 | 0 | 3 | Deep Learning, Data Mining, Machine Learning |
| 2. | 60 PDS E62 | Theoretical and Computational Neuroscience | PE | 3 | 3 | 0 | 0 | 3 | Data Mining, Machine Learning |
| 3. | 60 PDS E63 | Fog Computing | PE | 3 | 3 | 0 | 0 | 3 | Data Mining, Machine Learning |
| 4. | 60 PDS E64 | Healthcare Data Analytics | PE | 3 | 3 | 0 | 0 | 3 | Data Mining, Machine Learning |
| 5. | 60 PDS E65 | Real Time Systems | PE | 3 | 3 | 0 | 0 | 3 | Data Mining, Machine Learning |



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## AUDIT COURSES SEMESTER (I / II) (AC)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Prerequisite |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 60 PAC 001 | English for Research Paper Writing | AC | 2 | 2 | 0 | 0 | 0 | - |
| 2. | 60 PAC 002 | Disaster Management | AC | 2 | 2 | 0 | 0 | 0 | - |
| 3. | 60 PAC 003 | Constitution of India | AC | 2 | 2 | 0 | 0 | 0 | - |

## CAREER GUIDANCE COURSES (CG)

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C | Prerequisite |
|---|---|---|---|---|---|---|---|---|---|
| 1. | 60 PDS 2P1 | Term Paper and Seminar | CG | 2 | 0 | 0 | 2 | 0 | Domain Knowledge in Thrust Areas |
| 2. | 60 PDS 3P1 | Project Work Phase - I | CG | 12 | 0 | 0 | 12 | 6 | Term Paper and Seminar |
| 3. | 60 PDS 4P1 | Project Work Phase - II | CG | 24 | 0 | 0 | 24 | 12 | Term Paper and Seminar |

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**COURSES OF STUDY**

**(For the candidates admitted in 2024-2025)**

### SEMESTER I

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 PDS 101 | Mathematics for Data Science | PC | 5 | 3 | 1 | 0 | 4 |
| 2. | 60 PED 001/ 60 PDB E26 | Research Methodology and IPR | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 60 PDS 102 | Data Analytics using Python | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 60 PDS 103 | Advanced Data Management | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 60 PDS 104 | Machine Learning Techniques | PC | 3 | 3 | 0 | 0 | 3 |
| 6. | 60 PDS E1* | Professional Elective I | PE | 3 | 3 | 0 | 0 | 3 |
| 7. | 60 PAC 001 | English for Research Paper Writing | AC | 2 | 0 | 0 | 2 | 0 |
| **PRACTICALS** | | | | | | | | |
| 8. | 60 PDS 1P1 | Machine Learning Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **26** | **18** | **1** | **6** | **21** |



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## SEMESTER II

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 PDS 201 | Exploratory Data Analysis | PC | 3 | 3 | 0 | 0 | 3 |
| 2. | 60 PDS 202 | Advanced Machine Learning | PC | 3 | 3 | 0 | 0 | 3 |
| 3. | 60 PDS 203 | Business Analytics | PC | 3 | 3 | 0 | 0 | 3 |
| 4. | 60 PDS 204 | Data Security and Privacy | PC | 3 | 3 | 0 | 0 | 3 |
| 5. | 60 PDS E2* | Professional Elective II | PE | 3 | 3 | 0 | 0 | 3 |
| 6. | 60 PDS E3* | Professional Elective III | PE | 3 | 3 | 0 | 0 | 3 |
| 7. | 60 PAC 002 | Disaster Management | AC | 2 | 2 | 0 | 0 | 0 |
| **PRACTICALS** | | | | | | | | |
| 8. | 60 PDS 2P1 | Term Paper and Seminar | CG | 2 | 0 | 0 | 2 | 0 |
| 9. | 60 PDS 2P2 | Exploratory Data Analysis Laboratory | PC | 4 | 0 | 0 | 4 | 2 |
| | | | **TOTAL** | **26** | **20** | **0** | **06** | **20** |

## SEMESTER III

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | 60 PDS 301 | Deep Learning | PC | 5 | 3 | 1 | 0 | 4 |
| 2. | 60 PDS E4* | Professional Elective IV | PE | 3 | 3 | 0 | 0 | 3 |
| 3. | 60 PDS E5* | Professional Elective V | PE | 3 | 3 | 0 | 0 | 3 |
| 4. | 60 PDS E6* | Professional Elective VI | PE | 3 | 3 | 0 | 0 | 3 |
| **PRACTICALS** | | | | | | | | |
| 5. | 60 PDS 3P1 | Project Work Phase - I | CG | 12 | 0 | 0 | 12 | 6 |
| | | | **TOTAL** | **26** | **12** | **01** | **12** | **19** |

## SEMESTER IV

| S.No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **PRACTICALS** | | | | | | | | |
| 1. | 60 PDS 4P1 | Project Work Phase - II | CG | 24 | 0 | 0 | 24 | 12 |
| | | | **TOTAL** | **24** | **0** | **0** | **24** | **12** |

**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE: 72**

**PC : Professional Core**

**PE : Professional Elective**

**CG : Career Guidance Courses**

**AC : Audit Courses**

**L : Lecture**

**T : Tutorial**

**P : Practical**

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**M. Tech. Degree Programme**

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**SCHEME OF EXAMINATIONS**

**(For the candidates admitted in 2024 - 2025)**

**FIRST SEMESTER**

| S.No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment * | End Semester Exam ** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1 | 60 PDS 101 | Mathematics for Data Science | 2 | 40 | 60 | 100 | 45 | 100 |
| 2 | 60 PED 001 / 60 PDB E26 | Research Methodology and IPR | 2 | 40 | 60 | 100 | 45 | 100 |
| 3 | 60 PDS 102 | Data Analytics using Python | 2 | 40 | 60 | 100 | 45 | 100 |
| 4 | 60 PDS 103 | Advanced Data Management | 2 | 40 | 60 | 100 | 45 | 100 |
| 5 | 60 PDS 104 | Machine Learning Techniques | 2 | 40 | 60 | 100 | 45 | 100 |
| 6. | 60 PDS E1* | Professional Elective I | 2 | 40 | 60 | 100 | 45 | 100 |
| 7. | 60 PAC 001 | English for Research Paper Writing | 2 | 100 | - | 100 | - | 100 |
| **PRACTICAL** | | | | | | | | |
| 8. | 60 PDS 1P1 | Machine Learning Laboratory | 2 | 60 | 40 | 100 | 45 | 100 |

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for practical End Semester Examination.



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| 60 PDS 101 | Mathematics for Data Science | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 1 | 0 | 4 |

**Objective(s)**

- To introduce the basics of data science
- To enrich the skills in linear algebra models
- To understand the concepts of fitting of curves and regression
- To expose the knowledge optimization techniques in advanced fields.
- To impart the knowledge in data science methods.

**Prerequisite**

Basic Knowledge of probability and Statistics, Data Mining

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Analyze the concepts of linear algebra in data science problems. | Remember |
| **CO2** | Apply the properties, eigen values and eigen vectors based on linear algebra. | Apply |
| **CO3** | Solve the real time applications using regression analysis and estimation. | Apply |
| **CO4** | Compare the optimization techniques to solve the machine learning | Apply |
| **CO5** | Apply the data science concepts as advanced models. | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 2 | 3 | 3 | 1 | 2 |
| **CO3** | 3 | 2 | 3 | 3 | 1 | 2 |
| **CO4** | 3 | 3 | 2 | 3 | 1 | 2 |
| **CO5** | 3 | 3 | 2 | 3 | 1 | 2 |
| **3- Strong; 2-Medium; 1-Some** | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 00 | 00 | 00 |
| Knowledge (Kn) | 20 | 20 | 20 |
| Apply (Ap) | 40 | 40 | 80 |
| Analyse (An) | 00 | 00 | 00 |
| Evaluate(Ev) | 00 | 00 | 00 |
| Create (Cr) | 00 | 00 | 00 |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS 101 - Mathematics for Data Science** | | | | | | | | |
| **PDS: M. Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Basics of Data Science**<br>Introduction, typology of problems, importance of linear algebra, statistics and optimization from a data science perspective, structured thinking for solving data science problems | [9] |
| **Linear Algebra**<br>Matrices and their properties (determinants, traces, rank, nullity, etc.), eigenvalues and eigenvectors, Matrix factorizations (The Cholesky decomposition, QR factorization, Singular value decomposition), inner products, distance measures, projections, notion of hyper planes, Half planes | [9] |
| **Regression Analysis and Estimation**<br>Curve fitting by method of least squares - Correlation Properties of correlation coefficient - Linear regression - Least square estimation of regression coefficients - Regression lines - Maximum Likelihood Estimation | [9] |
| **Optimization**<br>Unconstrained optimization, necessary and sufficiency conditions for optima, gradient descent methods, constrained optimization, KKT conditions, introduction to non-gradient techniques, introduction to least squares optimization | [9] |
| **Data Science Methods**<br>Linear regression as an exemplar function approximation problem, linear classification problems | [9] |
| **Total Hours: 45+15(Tutorial)** | **60** |

| **Text book(s):** | |
|---|---|
| 1. | David C. Lay, 'Linear Algebra and its Applications', 5th Edition, Pearson Education, 2014. |
| 2. | B.S. Grewal, 'Higher Engineering Mathematics', 43rdEdition, Khanna Publishers, Delhi, 2014. |
| **Reference(s):** | |
| 1. | G. Strang 'Introduction to Linear Algebra', 5th Edition, Wellesley-Cambridge Press, 2016. |
| 2. | Bendat, J. S. and A. G. Piersol, 'Random Data: Analysis and Measurement Procedures', 4th Edition, John Wiley & Sons, 2010. |
| 3. | Montgomery, D. C. and G. C. Runger, 'Applied Statistics and Probability for Engineers', 5th Edition, John Wiley & Sons, 2011. |
| 4. | Cathy O'Neil and Rachel Schutt, 'Doing Data Science', 4th Edition, O'Reilly Media, Fourth Edition, 2016. |



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## Course Contents and Lecture Schedule

| S.No. | Topic | No. of Hours |
|---|---|---|
| **1** | **Basics of Data Science** | |
| 1.1 | Introduction | 1 |
| 1.2 | Typology of problems | 1 |
| 1.3 | Importance of linear algebra | 1 |
| 1.4 | Tutorial | 2 |
| 1.5 | Statistics and optimization from a data science perspective | 1 |
| 1.6 | Structured thinking for solving data science problems | 2 |
| 1.7 | Tutorial | 2 |
| **2** | **Linear Algebra** | |
| 2.1 | Matrices and their properties (determinants, traces, rank, nullity, etc.), | 2 |
| 2.2 | Eigenvalues and eigenvectors | 2 |
| 2.3 | Matrix factorizations - The Cholesky decomposition | 1 |
| 2.4 | QR factorization | 1 |
| 2.5 | Singular value decomposition | 1 |
| 2.6 | Inner products | 1 |
| 2.7 | Distance measures, projections | 1 |
| 2.8 | Tutorial | 2 |
| 2.9 | Notion of hyper planes, Half planes | 1 |
| 2.10 | Tutorial | 2 |
| 3 | **Regression Analysis and Estimation** | |
| 3.1 | Curve fitting by method of least squares | 2 |
| 3.2 | Correlation, Properties of correlation coefficient | 2 |
| 3.3 | Linear regression | 1 |
| 3.4 | Tutorial | |
| 3.5 | Least square estimation of regression coefficients - Regression lines | 1 |
| 3.6 | Maximum Likelihood Estimation | 1 |
| 3.7 | Tutorial | 2 |
| **4** | **Optimization** | |
| 4.1 | Unconstrained optimization | 2 |
| 4.2 | Necessary and sufficiency conditions for optima | 1 |
| 4.3 | Gradient descent methods | 1 |
| 4.4 | Constrained optimization | 2 |
| 4.5 | KKT conditions | 2 |
| 4.6 | Tutorial | 2 |
| 4.7 | Introduction to non-gradient techniques | 1 |
| 4.8 | Introduction to least squares optimization | 1 |
| 4.9 | Tutorial | 2 |
| **5** | **Data Science Methods** | |
| 5.1 | Linear regression as an exemplar function approximation problem | 3 |
| 5.2 | Tutorial | 2 |
| 5.3 | Linear classification problems | 4 |
| 5.4 | Tutorial | 2 |
| | **Total 45+15(Tutorial)** | 60 |

## Course Designers

Dr. S. Muthukumar (muthukumar@ksrct.ac.in)

Rev. No.3/w.e.f. 22.07.2024 Approved Passed in BoS Meeting held on 24/05/2024in Academic Council Meeting held on 25/05/2024

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| 60 PED 001 / 60 PDB E26 | Research Methodology and IPR | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

**Objective(s)**

- To understand the research process and design.
- To gain the knowledge about sources and collection of research data.
- To understand the procedure of data analysis and preparation of reports.
- To gain the knowledge on intellectual property rights.
- To enlighten the system of patents and benefits

**Prerequisite**

**Nil**

**Course Outcomes**

**On the successful completion of the course, students will be able**

| | | |
|---|---|---|
| **CO1** | To understand the research process and design. | Apply |
| **CO2** | To gain the knowledge about sources and collection of research data | Apply |
| **CO3** | To understand the procedure of data analysis and preparation of reports. | Apply |
| **CO4** | To gain the knowledge on intellectual property rights. | Apply |
| **CO5** | To enlighten the system of patents and benefits | Analyze |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 2 |
| **3- Strong; 2-Medium; 1-Some** | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Semester Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 10 | 10 | 30 |
| Understand(Un) | 20 | 20 | 30 |
| Apply(Ap) | 10 | 10 | 30 |
| Analyse(An) | 20 | 20 | 10 |
| Evaluate(Ev) | - | - | - |
| Create(Cr) | - | - | - |



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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PED 001 / 60 PDB E26 - Research Methodology and IPR** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Research Design**<br>Overview of research process and design- Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys, Selection of the Right Medium and Journal for publication, Translation of Research | [9] |
| **Data Collection and Sources**<br>Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying. | [9] |
| **Data Analysis and Reporting**<br>Overview of Multivariate Analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation. Checks for Plagiarism, Falsification, Fabrication, and Misrepresentation | [9] |
| **Intellectual Property Rights**<br>Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance. | [9] |
| **Patents**<br>Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents. | [9] |
| **Total Hours** | **45** |

| **Text Book(s):** | |
|---|---|
| 1. | David I. Bainbridge, “Intellectual Property”, Longman, 9th Edition, 2012. |
| 2. | Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012). |
| **Reference(s):** | |
| 1. | Chawla H S., “Introduction to Intellectual Property Rights”, CBS PUB & DIST PVT Limited, INDIA, 2019. |
| 2. | Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007 |
| 3. | David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007 |
| 4. | Arun K. Narasani, Kankanala K.C., Radhakrishnan V., “Indian Patent Law and Practice”, Oxford University Press, 2010. |
| 5. | Richard Stim, “Patent, Copyright & Trademark - An Intellectual Property Desk Reference”, NOLO Publishers, 2020. |
| 6. | The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013. |



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**Course Content and Lecture Schedule**

| S.No. | Topics | No. of hours |
|---|---|---|
| 1.0 | **Research Design** | |
| 1.1 | Overview of research process and design | 1 |
| 1.2 | Use of Secondary and exploratory data to answer the research question | 2 |
| 1.3 | Qualitative research | 1 |
| 1.4 | Observation studies | 1 |
| 1.5 | Experiments and Surveys | 1 |
| 1.6 | Selection of the Right Medium and Journal for publication | 2 |
| 1.7 | Translation of Research | 1 |
| 2.0 | **Data Collection and Sources** | |
| 2.1 | Measurements, Measurement Scales | 2 |
| 2.2 | Questionnaires and Instruments | 2 |
| 2.3 | Sampling and methods | 2 |
| 2.4 | Data - Preparing, Exploring, examining and displaying | 3 |
| 3.0 | **Data Analysis and Reporting** | |
| 3.1 | Overview of Multivariate analysis | 1 |
| 3.2 | Hypotheses testing and Measures of Association | 2 |
| 3.3 | Presenting Insights | 1 |
| 3.4 | Findings using written reports and oral presentation | 2 |
| 3.5 | Checks for Plagiarism | 1 |
| 3.6 | Falsification | 1 |
| 3.7 | Fabrication, and Misrepresentation | 1 |
| 4.0 | **Intellectual Property Rights** | |
| 4.1 | Intellectual Property – The concept of IPR | 1 |
| 4.2 | Evolution and development of concept of IPR, IPR development process | 2 |
| 4.3 | Trade secrets, utility Models, IPR & Bio diversity | 2 |
| 4.4 | Role of WIPO and WTO in IPR establishments | 1 |
| 4.5 | Right of Property, Common rules of IPR practices | 1 |
| 4.6 | Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance | 2 |
| 5.0 | **Patents** | |
| 5.1 | Patents – objectives and benefits of patent, Concept, features of patent | 2 |
| 5.2 | Inventive step, Specification, Types of patent application | 2 |
| 5.3 | Process E-filling, Examination of patent | 1 |
| 5.4 | Grant of patent, Revocation | 1 |
| 5.5 | Equitable Assignments, Licences, Licensing of related patents | 2 |
| 5.6 | Patent agents, Registration of patent agents | 1 |

**Course Designer**

Dr.A.Murugesan – murugesana@ksrct.ac.in



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| 60 PDS 102 | Data Analytics using Python | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objective(s)

- To learn basic and advanced features in NumPy (Numerical Python)
- To create informative visualization with matplotlib
- To apply the pandas group by facility to slice, dice and summarize datasets
- To provide an in-depth knowledge of the various libraries and packages required to perform data analysis, data visualization, web scraping and machine learning using python
- To learn how to solve real-world

## Prerequisite

Basic knowledge of Higher Secondary Mathematics, Python.

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Analyze the roles and stages of data science projects | Analyze |
| **CO2** | Apply the data structures provided by numpy library for arrays and vectorized computation | Apply |
| **CO3** | Analyse the data structures provided by pandas library for data analysis | Analyse |
| **CO4** | Perform data wrangling, cleaning and transformation using python and use matplot lib for plotting and visualizing the datasets | Apply |
| **CO5** | Demonstrate data aggregation and time series analysis using python programming Language | Apply |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO3** | 3 | 3 | 2 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 2 | 3 |
| **3-Strong; 2-Medium; 1-Some** | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 30 | 30 | 30 |
| Understand (Kn) | 10 | 10 | 20 |
| Apply (Ap) | 30 | 30 | 40 |
| Analyse (An) | 00 | 00 | 00 |
| Evaluate(Ev) | 00 | 00 | 00 |
| Create (Cr) | 00 | 00 | 00 |



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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 PDS 102 - Data Analytics using Python | | | | | | | | |
| PDS: M. Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation.<br>**Numpy Basics: Arrays**<br>The NumPy ndarray: A Multidimensional Array Object – Universal Functions: Fast Elementwise Array Functions – Data Processing Using Arrays | [9] |
| **Vectorized Computation and Pandas**<br>File Input and Output with Arrays – Linear Algebra – Random Number Generation – Random Walks. Introduction to pandas Data Structures – Essential Functionality – Summarizing and Computing Descriptive Statistics – Handling Missing Data – Hierarchical Indexing – Other pandas Topics | [9] |
| **Data Loading, Storage, and File Formats & Data Wrangling: Clean, Transform, Merge, Reshape**<br>Reading and Writing Data in Text Format – Binary Data Formats – Interacting with HTML and Web APIs – Interacting with Databases Data Wrangling: Clean, Transform, Merge, Reshape Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String Manipulation – USDA Food Database | [9] |
| **Plotting and Visualization**<br>A Brief matplot lib API Primer – Plotting Functions in pandas – Plotting Maps: Visualizing Haiti Earthquake Crisis Data – Python Visualization Tool Ecosystem | [9] |
| **Data Aggregation and Group Operations & Time Series**<br>Group By Mechanics – Data Aggregation – Group-wise Operations and Transformations – Pivot Tables and Cross-Tabulation TIME SERIES: Date and Time Data Types and Tools – Time Series Basics – Date Ranges, Frequencies, and Shifting – Time Zone Handling – Periods and Period Arithmetic – Resampling and Frequency Conversion – Time Series Plotting – Moving Window Functions – Performance and Memory Usage Notes | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | Wes McKinney, 'Python for Data Analysis', O'Reilly Media,2012 |
| 2. | Sebastian Raschka, 'Python Machine Learning',Packpub.com,2015 |

**Reference(s):**

| | |
|---|---|
| 1. | Fabio Nelli , 'Python Data Analytics: Data Analysis and Science Using Pandas, matplotlib, and the Python' , Apress, 2015 |
| 2. | Wes McKinney, 'Python for Data Analysis Data Wrangling with PANDAS, NUMPY, and Python', O'Reilly, 2018 |
| 3. | Jake Vanderplas, 'Python Data Science Handbook: Essential Tools for Working with Data', O′Reilly Media,2016 |
| 4. | AvinashNavlani, 'Python Data Analysis: Perform data collection, data processing, wrangling, visualization, and model building using Python', Packt Publishing,2021. |



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**Course Contents and Lecture Schedule**

| S. No. | Topic | No. of Hours |
|---|---|---|
| **1** | **Introduction** | |
| 1.1 | Data science process | 1 |
| 1.2 | roles, stages in data science project | 1 |
| 1.3 | working with data from files | 1 |
| 1.4 | working with relational databases | 1 |
| 1.5 | exploring data – managing data | 1 |
| 1.6 | cleaning and sampling for modeling | 1 |
| 1.7 | Validation. | 1 |
| **2** | **Numpy Basics: Arrays,Vectorized Computation and Pandas** | |
| 2.1 | The NumPy ndarray: A Multidimensional Array Object | 1 |
| 2.2 | Universal Functions: Fast Elementwise Array Functions | 1 |
| 2.3 | Data Processing Using Arrays | 1 |
| 2.4 | File Input and Output with Arrays , Linear Algebra | 1 |
| 2.5 | Random Number Generation, Random Walks. | 1 |
| 2.6 | Introduction to pandas Data Structures , Essential Functionality | 2 |
| 2.7 | Summarizing and Computing Descriptive Statistics | 1 |
| 2.8 | Handling Missing Data | 1 |
| 2.9 | Hierarchical Indexing , Other pandas Topics | |
| **3** | **Data Loading, Storage, and File Formats & Data Wrangling: Clean, Transform, Merge, Reshape** | |
| 3.1 | Reading and Writing Data in Text Format , Binary Data Formats | 1 |
| 3.2 | Interacting with HTML and Web APIs | 1 |
| 3.3 | Interacting with Databases DATA WRANGLING: CLEAN, TRANSFORM, MERGE, RESHAPE | 2 |
| 3.4 | Combining and Merging Data Sets | 1 |
| 3.5 | Reshaping and Pivoting | 1 |
| 3.6 | Data Transformation | 1 |
| 3.7 | String Manipulation | 1 |
| 3.8 | USDA Food Database | 1 |
| **4** | **Plotting and Visualization** | |
| 4.1 | A Brief matplot lib API Primer | 1 |
| 4.2 | Plotting Functions in pandas | 2 |
| 4.3 | Plotting Maps | 1 |
| 4.4 | Plotting Maps: Visualizing Haiti Earthquake Crisis Data | 2 |
| 4.5 | Python Visualization Tool Ecosystem | 2 |
| **5** | **Data Aggregation and Group Operations & Time Series** | |
| 5.1 | GroupBy Mechanics | 1 |
| 5.2 | Data Aggregation | 1 |
| 5.3 | Group-wise Operations and Transformations | 1 |
| 5.4 | Pivot Tables and Cross-Tabulation TIME SERIES | 1 |
| 5.5 | Date and Time Data Types and Tools | 1 |
| 5.6 | Time Series Basics , Date Ranges, Frequencies, and Shifting | 1 |
| 5.7 | Time Zone Handling , Periods and Period Arithmetic | 1 |
| 5.8 | Resampling and Frequency Conversion, Time Series Plotting | 1 |
| 5.9 | Moving Window Functions , Performance and Memory Usage Notes | 1 |
| | **Total** | **45** |

**Course Designers**

**Ms.S.Geetha – (geetha@ksrct.ac.in)**

Rev. No.3/w.e.f. 22.07.2024 Approved Passed in BoS Meeting held on 24/05/2024in Academic Council Meeting held on 25/05/2024

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| 60 PDS 103 | Advanced Data Management | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objective(s)

- To study basic SQL queries
- To design database using data models and normalization
- To study concurrency control techniques and recovery concept
- To understand the basic concepts of NoSQL database
- To learn various data analysis techniques in the internet Context

## Prerequisite

Basic knowledge of Database Management System, Big Data

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Describe the need for managing/storing data and identify the value and relative importance of data management | Understand |
| **CO2** | Describe fundamentals of Data Management techniques suitable for Enterprise Applications | Apply |
| **CO3** | Analyse the different concurrency control protocols in a transaction | Analyse |
| **CO4** | Apply Data Management Solution for Internet Applications | Apply |
| **CO5** | Describe various data analysis techniques in the internet Context | Analyze |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 2 | 3 |
| **CO2** | 3 | 3 | 2 | 2 | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 3 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 2 | 3 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 30 | 00 | 30 |
| Understand(Un) | 00 | 00 | 00 |
| Apply (Ap) | 30 | 30 | 60 |
| Analyze (An) | 00 | 30 | 30 |
| Evaluate(Ev) | 00 | 00 | 00 |
| Create (Cr) | 00 | 00 | 00 |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS 103 - Advanced Data Management | | | | | | | | |
| PDS: M. Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Introduction to Data Science and Class Logistics/Overview, Statistical Inference and Exploratory Data Analysis, Principles of Data Management, SQL for Data Science: SQL Basics, SQL Joins and /aggregates, Grouping and query evaluation, SQL Sub-queries, Key Principles of RDBM | [9] |
| **Data Storaging and Indexing**<br>Data Models, Data Warehousing, OLAP, Data Storage and Indexing , Query Optimization and Cost Estimation, Datalog, E/R Diagrams and Constraints, Design Theory, BCNF | [9] |
| **Data Management Solutions for Enterprise Applications**<br>Introduction to Transactions, Transaction Implementations, Transaction Model, Database Concurrency Control Protocols, Transaction Failures and Recovery, Database Recovery Protocols. | [9] |
| **Parallel Databases**<br>Introduction to NoSQL database , Apache Cassandra, Redis, MongoDB, Apache Hive | [9] |
| **Data Management Solution for Internet Applications**<br>Google's Application Stack: Chubby Lock Service, BigTable Data Store, and Google File System; Yahoo's key-value store: PNUTS; Amazon's key-value store: Dynamo; | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | Hector Garcia-Molina, Jennifer Widom and Jeffrey D. Ullman, 'Database Systems: The Complete Handbook', 2nd Edition, Pearson India Education, 2013. |
| 2. | Aaron Ploetz, Devram Kandhare, Sudarshan Kadambi and Xun Wu, 'Seven NoSQL Databases in a Week: Get up and running with the fundamentals', 1st Edition, Packt Publishing, 2018. |

**Reference(s):**

| | |
|---|---|
| 1. | Raghu Ramakrishnan and Johannes Gehrke, Database management systems, 3rd Edition, McGraw Hill Publication, 2014. |
| 2. | Serge Abiteboul, Richard Hull and Victor Vianu, Foundations of Databases, AddisonWesley, 1995. |
| 3. | Edward Capriolo, Dean Wampler and Jason Rutherglen, Programming Hive: Data Warehouse and Query Language for Hadoop, 1st Edition, O'Reilly Media, Inc., 2012 |
| 4. | Gerhard Weikum and Gottfried Vossen, Transactional Information Systems: Theory, Algorithms, and the Practice of Concurrency Control and Recovery, 1st Edition, Morgan Kaufmann, 2002. |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| 1 | **Introduction** | |
| 1.1 | Introduction to Data Science and Class Logistics/Overview | 1 |
| 1.2 | Statistical Inference | 1 |
| 1.3 | Exploratory Data Analysis | 1 |
| 1.4 | Principles of Data Management | 1 |
| 1.5 | SQL for Data Science: SQL Basics | 1 |
| 1.6 | SQL Joins and aggregates | 1 |
| 1.7 | Grouping and query evaluation | 1 |
| 1.8 | SQL Sub-queries | 1 |
| 1.9 | Key Principles of RDBM | 1 |
| 2 | **Data Storaging and Indexing** | |
| 2.1 | Data Models | 1 |
| 2.2 | Data Warehousing | 1 |
| 2.3 | OLAP | 1 |
| 2.4 | Data Storage and Indexing | 1 |
| 2.5 | Query Optimization and Cost Estimation | 1 |
| 2.6 | Datalog | 1 |
| 2.7 | E/R Diagrams and Constraints | 1 |
| 2.8 | Design Theory | 1 |
| 2.9 | BCNF | 1 |
| 3 | **Data Management Solutions for Enterprise Applications** | |
| 3.1 | Introduction to Transactions | 1 |
| 3.2 | Transaction Implementations | 1 |
| 3.3 | Transaction Model | 1 |
| 3.4 | Database Concurrency Control Protocols - Lock Based Concurrency Control Protocol. | 1 |
| 3.5 | Time Stamp Concurrency Control Protocol | 1 |
| 3.6 | Transaction Failures and Recovery - Stealing Frames and Forcing Pages | 1 |
| 3.7 | Recovery-Related Steps during Normal Execution | 1 |
| 3.8 | Database Recovery Protocols – ARIES | 1 |
| 3.9 | Recovering from System crash | 1 |
| 4 | **Parallel Databases** | |
| 4.1 | Introduction to NoSQL database | 1 |
| 4.2 | Apache Cassandra – Features, Use Cases, Anti Patterns | 1 |
| 4.3 | Hardware selection, Installation, configuration, node configuration, Running. | 1 |
| 4.4 | Redis – features, Use cases, Anti Patterns | 1 |
| 4.5 | Data modeling and Application Design, Hardware selection, Installation, configuration | 1 |
| 4.6 | MongoDB – Installation, Data types, Data Models | 1 |



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| | | |
|---|---|---|
| 4.7 | MongoDB indexing, Replication, Sharding | 1 |
| 4.8 | Apache Hive – Data types, Data definition, Data manipulation | 1 |
| 4.9 | Queries, Views, Indexes, Schema, Tuning. | 1 |
| 5 | **Data Management Solution for Internet Applications** | |
| 5.1 | Google's Application Stack: Chubby Lock Service | 1 |
| 5.2 | BigTable Data Store and Google File System – Data model | 1 |
| 5.3 | Architecture | 1 |
| 5.4 | Yahoo's key-value store: PNUTS – Functionality | 1 |
| 5.5 | System architecture, Replication and Consistency | 1 |
| 5.6 | Applications | 1 |
| 5.7 | Amazon's key-value store: Dynamo Features, Data Partitioning | 1 |
| 5.8 | Design Principles, Techniques, | 1 |
| 5.9 | Replication, Versioning, Failure detection and Management | 1 |
| | Total | 45 |

**Course Designers**

**R.T.Dinesh Kumar (dineshkumarrt@ksrct.ac.in**



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| 60 PDS 104 | Machine Learning Techniques | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objective(s)

- To gain the knowledge about learning, regression algorithms.
- To learn the neural networks and genetic algorithms.
- To familiarize the Bayesian and Computational Learning.
- To know the Instant Based Learning.
- To expose the Knowledge in Advanced Learning.

## Prerequisite

Basic knowledge of Data mining and its applications

## Course Outcomes

**At the end of the course, the students will be able to**

| | | |
|---|---|---|
| **CO1** | Implement the concepts of learning process and Linear and logistic regression. | Apply |
| **CO2** | Develop the Genetic Algorithms and programming. | Create |
| **CO3** | Apply the Concept of Computational Learning process | Apply |
| **CO4** | Explore the Concept of Instant Based Learning methods. | Analyse |
| **CO5** | Acquire Knowledge in Advanced Learning methods. | Understand |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 3 | 2 | 2 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 2 | 3 | 2 |
| **CO5** | 3 | 2 | 2 | 3 | 2 | 3 |

**3-Strong; 2-Medium; 1-Some**

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination(Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 00 | 00 | 00 |
| Understand(Un) | 20 | 20 | 30 |
| Apply(Ap) | 20 | 20 | 30 |
| Analyse(An) | 10 | 10 | 20 |
| Evaluate(Ev) | 00 | 00 | 00 |
| Create(Cr) | 10 | 10 | 20 |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS 104 - Machine Learning Techniques | | | | | | | | |
| PDS: M.Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Learning problems, perspectives and issues, concept learning, version spaces and candidate eliminations, inductive bias, decision tree learning, representation, algorithm, heuristic space search. Linear and logistic regression | [9] |
| **Neural Networks and Genetic Algorithms**<br>Neural network representation, problems, perceptron's, multilayer networks and back propagation algorithms, advanced topics, hyper parameter optimization, genetic algorithms, hypothesis space search, genetic programming, models of evaluation and learning | [9] |
| **Bayesian and Computational Learning**<br>Bayes theorem, concept learning, maximum likelihood – minimum description length principle, Bayes optimal classifier, Gibbs algorithm, naïve Bayes classifier, Bayesian belief network, EM algorithm, probability learning, sample complexity, finite and infinite hypothesis spaces, mistake bound model | [9] |
| **Instant Based Learning**<br>K- nearest neighbor learning, locally weighted regression, radial basis functions, Case based learning | [9] |
| **Advanced Learning**<br>Learning sets of rules, sequential covering algorithm, learning rule set, first order rules, sets of first order rules, induction on inverted deduction, inverting resolution, analytical learning, perfect domain theories, explanation base learning, FOCL algorithm, reinforcement learning task, Q-learning, temporal difference learning | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | Tom M. 'Mitchell, Machine Learning', 2nd Edition, McGraw-Hill Education India Private Limited, 2017. |
| 2. | Andreas Muller,Sarah Guido, 'Introduction to Machine Learning with Python: A Guide for Data Scientists',4th Edition,O'Reilly,2018. |
| **Reference(s):** | |
| 1. | Stephen Marsland, 'Machine Learning: An Algorithmic Perspective', 2nd Edition, CRC Press, 2014. |
| 2. | D. Barber, 'Bayesian Reasoning and Machine Learning', Cambridge University Press, 2012. |
| 3. | Ethem Alpaydin, 'Introduction to Machine Learning(Adaptive Computation and Machine Learning Series)',3rd Edition, MIT Press, 2014. |
| 4. | Ethem Alpaydin, 'Introduction to Machine Learning', 3rd Editon, The MIT Press, 2015. |



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## Course Contents and Lecture Schedule

| S.No | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction** | 1 |
| 1.1 | Learning problems | 1 |
| 1.2 | Perspectives and issues | 1 |
| 1.3 | Concept learning | 1 |
| 1.4 | Version spaces and candidate eliminations | 1 |
| 1.5 | Inductive bias | 1 |
| 1.6 | Decision tree learning | 1 |
| 1.7 | Representation, algorithm | 1 |
| 1.8 | Heuristic space search | 1 |
| 1.9 | Linear and logistic regression | 1 |
| **2** | **Neural Networks and Genetic Algorithms** | 1 |
| 2.1 | Neural network representation, problems, | 1 |
| 2.2 | Perceptron's, | 1 |
| 2.3 | Multilayer networks and back propagation algorithms | 1 |
| 2.4 | Advanced topics, | 1 |
| 2.5 | Hyper parameter optimization | 1 |
| 2.6 | Genetic algorithms | 1 |
| 2.7 | Hypothesis space search | 1 |
| 2.8 | Genetic programming | 1 |
| 2.9 | Models of evaluation and learning | 1 |
| **3** | **Bayesian and Computational Learning** | 1 |
| 3.1 | Bayes theorem | 1 |
| 3.2 | Concept learning | 1 |
| 3.3 | Maximum likelihood – minimum description length principle | 1 |
| 3.4 | Bayes optimal classifier | 1 |
| 3.5 | Gibbs algorithm, naïve Bayes classifier, Bayesian belief network | 1 |
| 3.6 | EM algorithm, probability learning | 1 |
| 3.7 | Sample complexity | 1 |
| 3.8 | Finite and infinite hypothesis spaces, | 1 |
| 3.9 | Mistake bound model | 1 |
| **4** | **Instant Based Learning** | 1 |
| 4.1 | K- nearest neighbor learning | 2 |
| 4.2 | Locally weighted regression | 2 |
| 4.3 | Radial basis functions | 2 |
| 4.4 | Case based learning | 2 |
| **5** | **Advanced Learning** | 1 |
| 5.1 | Learning sets of rules | 1 |
| 5.2 | Sequential covering algorithm | 1 |
| 5.3 | Learning rule set, first order rules | 1 |
| 5.4 | Sets of first order rules, induction on inverted deduction | 1 |
| 5.5 | Inverting resolution, analytical learning | 1 |
| 5.6 | Perfect domain theories, explanation base learning, , | 1 |
| 5.7 | FOCL algorithm | 1 |
| 5.8 | Reinforcement learning task, Q-learning | 1 |
| 5.9 | Temporal difference learning | 1 |
| | Total | 45 |

**Course Designers**

**Ms.B.Manimegalai (manimegalai@ksrct.ac.in)**

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| 60 PDS 1P1 | Machine Learning Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 4 | 2 |

**Objective(s)**

- To acquire knowledge in the hypothesis based concepts
- To learn the decision tree algorithms and back propagation algorithms
- To Know the Accuracy of the classifier, Precision, and Recall fo the dataset
- To understand the Baysian network & apply EM Algorithm to cluster dataset
- To gain the K Nearest neighbor algorithms

**Prerequisite**

Basic knowledge of probability and Statistics, Data Mining

**Course Outcomes**

**At the end of the course, the students will be able to**

| | | |
|---|---|---|
| **CO1** | Implement and demonstrate the FIND-S algorithm for hypothesis based on a given set of training data samples. | Apply |
| **CO2** | Demonstrate the working of the decision tree & implement the basic propagation algorithm. | Apply |
| **CO3** | Compute the Accuracy of the Classifier & Calculate the accuracy, Precision and Recall of dataset. | Apply |
| **CO4** | Construct an a Bayesian network & apply EM Algorithm to cluster a data sets | Apply |
| **CO5** | Implementation of K Nearest Neighbor algorithm & Non parametric locally weighted regression algorithm | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 3 | 2 | 2 | 3 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 2 | 3 |
| **3-Strong; 2-Medium; 1-Some** | | | | | | |

**Assessment Pattern**

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | - | - | - |
| Understand | - | - | - | - |
| Apply | 40 | 15 | 80 | 80 |
| Analyse | 10 | 10 | 20 | 20 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS 1P1 - Machine Learning Laboratory** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

**List of experiments**

1. Implementation of FIND S Algorithm
2. Implementation of Candidate Elimination
3. Implementation of Decision Tree
4. Implementation of Backpropagation Algorithm
5. Implementation of Naive Bayesian Classifier-Accuracy
6. Implementation of Naive Bayesian Classifier- Accuracy, Precision, Recall
7. Implementation of Naive Bayesian Classifier- Heart Patients Demonstration
8. Implementation of K-Means Algorithm
9. Implementation of K-Nearest Neighbour Algorithm
10. Implementation of Regression Algorithm

**Course Designers**

**Ms.B.Manimegalai (**manimegalai@ksrct.ac.in**)**

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**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE-637215**

**(An Autonomous Institution affiliated to Anna University)**

**M. Tech. Degree Programme**

**SCHEME OF EXAMINATIONS**

**(For the candidates admitted in 2024 - 2025)**

**SECOND SEMESTER**

| S.No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment * | End Semester Exam ** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1. | 60 PDS 201 | Exploratory Data Analysis | 2 | 40 | 60 | 100 | 45 | 100 |
| 2. | 60 PDS 202 | Advanced Machine Learning | 2 | 40 | 60 | 100 | 45 | 100 |
| 3. | 60 PDS 203 | Business Analytics | 2 | 40 | 60 | 100 | 45 | 100 |
| 4. | 60 PDS 204 | Data Security and Privacy | 2 | 40 | 60 | 100 | 45 | 100 |
| 5. | 60 PDS E2* | Professional Elective II | 2 | 40 | 60 | 100 | 45 | 100 |
| 6. | 60 PDS E3* | Professional Elective III | 2 | 40 | 60 | 100 | 45 | 100 |
| 7. | 60 PAC 002 | Disaster Management | 2 | 100 | - | 100 | - | 45 |
| **PRACTICAL** | | | | | | | | |
| 8. | 60 PDS 2P1 | Term Paper and Seminar | 2 | 100 | - | 100 | - | 100 |
| 9. | 60 PDS 2P2 | Exploratory Data Analysis Laboratory | 2 | 60 | 40 | 100 | 45 | 100 |

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for practical End Semester Examination.



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| 60 PDS 201 | Exploratory Data Analysis | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objective(s)

- To introduce big data and its importance towards analytics
- To familiarize the students with fundamentals of data analysis
- To expose the students to different of bigdata frameworks
- To compare structured and unstructured database
- To learn about the stream mining concepts
-

## Prerequisite

Basic knowledge of Data mining and machine learning techniques.

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Identify the differences between reporting and analytics | Understand |
| **CO2** | Demonstrate fundamental mathematics behind analytics | Understand |
| **CO3** | Install Hadoop and write Map Reduce Programs | Create |
| **CO4** | Critically analyze different big data frameworks for programming, storage and Statistical analysis | Analyse |
| **CO5** | Apply mining techniques for stream data | Apply |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | 3 | 2 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 2 | 2 | 3 | 2 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 00 | 00 | 00 |
| Understand (Un) | 60 | 00 | 40 |
| Apply (Ap) | 00 | 00 | 20 |
| Analyse (An) | 00 | 30 | 20 |
| Evaluate(Ev) | 00 | 00 | 00 |
| Create (Cr) | 00 | 30 | 20 |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS 201 - Exploratory Data Analysis | | | | | | | | |
| PDS: M.Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to data analytics**<br>Introduction to Big Data – Need for big data - Web Data – Evolution Of Analytic Scalability –Analytic Processes and Tools-Analysisvs Reporting–Core Analytics vs Advanced Analytics–Statistical significance–Sampling–inference-Modern Data Analytic Tools | [9] |
| **Data Analysis-Fundamentals**<br>Data Analysis Foundations-Univariate, bivariate and multivariate analysis of Numeric and Categorical Attributes– Graph Data - Kernel Methods - Kernel Matrix, Vector Kernels, Basic Kernel Operations in Feature Space and Kernels for Complex Objects - High-dimensional Data -Dimensionality Reduction - Principal Component Analysis, Kernel Principal Component Analysis, Singular Value Decomposition | [9] |
| **Analytical Frameworks-I**<br>Introduction to Hadoop and Map Reduce–Hadoop Features–Components of Hadoop-Hadoop Distributed File Systems (HDS) and Map Reduce Architectures – Hadoop Installation - WritingMapreduce Programs – Algorithms Using Map-Reduce - Matrix-Vector Multiplication, Relational-Algebra Operations,Grouping and Aggregation | [9] |
| **Analytical Frameworks–II**<br>Overview of Application development in Languages for Hadoop – PigLatin, Hive, jaql, Sqoop,Apachedrill,ClouderaImpala–Introduction to NoSQL databases-HBase,MongoDB–CouchDB<br>Introduction to R Language for statistical computing and visualization – R Installation and integration with Hadoop | [9] |
| **Mining Data Streams**<br>Introduction To Streams Concepts–Stream Data Model and Architecture-Stream Computing-Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream –Estimating Moments–Counting One nessina Window–Decaying Window | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | Bill Franks, 'Taming the Big DataTidalWave:Finding Opportunities in Huge Data Streams with Advanced Analytics',JohnWiley & sons,2012 |
| 2. | Mohammedj.Zakiand Wagner Meira, 'Data Mining and Analysis- Fundamental Concepts and Algorithms', Cambridge University Press, 2014. |
| 3. | Anand Rajaraman and Jeffrey David Ullman, 'Mining of Massive Datasets',Cambridge University Press,2012. |
| 4. | Vignesh Prajapati, 'Big Data Analytics with RandHadoop',Packt Publishing Ltd,2013. |

**Reference(s):**

| | |
|---|---|
| 1. | PaulZikopoulos and ChrisEaton, 'Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data', McGraw-Hill Education;1st Edition2011 |
| 2. | Philipp K. Janert, 'Data Analysis with Open Source Tools',O'Reilly Media, 2010. |
| 3. | Michael Berthold, DavidJ.Hand, 'Intelligent Data Analysis',Springer, 2007. |
| 4. | GlennJ.Myatt, 'Making Sense of Data', JohnWiley& Sons, 2007. |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction to data analytics** | |
| 1.1 | Introduction to Big Data | 1 |
| 1.2 | Need for big data, Web Data | 1 |
| 1.3 | Evolution Of Analytic Scalability | 1 |
| 1.4 | Analytic Processes and Tools | 1 |
| 1.5 | Analytics Reporting | 1 |
| 1.6 | Core Analytics vs Advanced Analytics | 1 |
| 1.7 | Statistical significance–Sampling | 1 |
| 1.8 | Inference | 1 |
| 1.9 | Modern Data Analytic Tools | 1 |
| **2** | **Data Analysis-Fundamentals** | |
| 2.1 | Data Analysis Foundations, Univariate | 1 |
| 2.2 | bivariate and multivariate analysis of Numeric and Categorical Attributes | 1 |
| 2.3 | Graph Data, Kernel Methods, Kernel Matrix, Vector Kernels | 1 |
| 2.4 | Basic Kernel Operations in Feature Space and Kernels for Complex Objects | 1 |
| 2.5 | High-dimensional Data | 1 |
| 2.6 | Dimensionality Reduction | 1 |
| 2.7 | Principal Component Analysis | 1 |
| 2.8 | Kernel Principal Component Analysis | 1 |
| 2.9 | Singular Value Decomposition | 1 |
| **3** | **Analytical Frameworks-I** | |
| 3.1 | Introduction to Hadoop and Map Reduce | 1 |
| 3.2 | Hadoop Features | 1 |
| 3.3 | Components of Hadoop | 1 |
| 3.4 | Hadoop Distributed File Systems (HDS) and Map Reduce Architectures | 1 |
| 3.4 | Hadoop Installation | 1 |
| 3.5 | Writing Mapreduce Programs | 1 |
| 3.6 | Algorithms Using Map-Reduce | 1 |
| 3.7 | Matrix-Vector Multiplication | 1 |
| 3.8 | Relational-Algebra Operations | 1 |
| 3.9 | Grouping and Aggregation | 1 |
| **4** | **Analytical Frameworks–II** | |
| 4.1 | Overview of Application development in Languages for Hadoop | 1 |
| 4.2 | Pig Latin, Hive, JAQL, Sqoop, | 1 |
| 4.3 | Apache Drill, Cloudera Impala | 1 |



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| | | |
|---|---|---|
| 4.4 | Introduction to NoSQL databases | 1 |
| 4.5 | HBase, | 1 |
| 4.6 | MongoDB | 1 |
| 4.7 | CouchDB | 1 |
| 4.8 | Introduction to R Language for statistical computing and visualization | 1 |
| 4.9 | R Installation and integration with Hadoop | 1 |
| **5** | **Mining Data Streams** | |
| 5.1 | Introduction To Streams Concepts | 1 |
| 5.2 | Stream Data Model and Architecture | 1 |
| 5.3 | Stream Computing | 1 |
| 5.4 | Sampling Data in a Stream | 1 |
| 5.5 | Filtering Streams | 1 |
| 5.6 | Counting Distinct Elements in a Stream | 1 |
| 5.7 | Estimating Moments | 1 |
| 5.8 | counting one messina window in data stream | 1 |
| 5.9 | Decaying Window | 1 |
| | **Total** | **45** |

**Course Designers**

**Dr.V.R.SADASIVAM- sadasivam@ksrct.ac.in**



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| 60 PDS 202 | Advanced Machine Learning | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

**Objective(s)**

- To understand of the Supervised and Unsupervised learning techniques
- To understand learning strategy for any given problem
- To study the various probability-based learning techniques
- To apply the concepts of dimension reduction and evolutionary models
- To understand graphical models in machine learning algorithm

**Prerequisite**

Basic knowledge of Machine Learning

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Understand the working of various advanced machine learning algorithms | Understand |
| **CO2** | Evaluate the appropriate machine learning strategy for any given problem | Evaluate |
| **CO3** | Apply the ensemble learning and probability based learning techniques | Apply |
| **CO4** | Analyze the decision tree for the given application | Analyse |
| **CO5** | Create the Dimensionality reduction techniques and Graph based models | Create |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 2 | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 2 |
| **CO4** | 2 | 3 | 3 | 2 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests(Marks) | | End Sem Examination(Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 10 | 10 | 30 |
| Understand(Un) | 20 | 20 | 30 |
| Apply(Ap) | 10 | 20 | 30 |
| Analyse(An) | 20 | 10 | 10 |
| Evaluate(Ev) | 00 | 00 | 00 |
| Create(Cr) | 00 | 00 | 00 |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS 202 - Advanced Machine Learning | | | | | | | | |
| PDS: M.Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression. | [9] |
| **Linear Models**<br>Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multilayer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines. | [9] |
| **Tree and Probabilistic Models**<br>Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map. | [9] |
| **Dimensionality Reduction and Evolutionary Models**<br>Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process. | [9] |
| **Graphical Models**<br>Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | Ethem Alpaydin, - 'Introduction to Machine Learning' 3rd Edition (Adaptive Computation and Machine Learning Series), 3rd Edition, MIT Press, 2014 |
| 2. | Kevin P. Murphy,' Machine Learning A Probabilistic Perspective', The MIT Press, 2012 |

**Reference(s):**

| | |
|---|---|
| 1. | Jason Bell, -' Machine learning – Hands on for Developers and Technical Professionals', 1st Edition, Wiley, 2014 |
| 2. | Peter Flach, - Machine Learning: The Art and Science of Algorithms that Make Sense of Data', 1st Edition, Cambridge University Press, 2012 |
| 3. | Stephen Marshland, - 'Machine Learning - An Algorithmic Perspective', 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014 |
| 4. | Bishop, Christopher, 'Pattern Recognition and Machine Learning', springer,2011 |

**Course Designers**

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| 60 PDS 203 | Business Analytics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

**Objective(s)**

- To expose with the basic rudiments of business intelligence system
- To Comprehend the modeling aspects behind Business Intelligence
- To learn the business intelligence life cycle and the techniques used in it
- To expose with different data analysis tools and techniques
- To apply the future technologies in business analytics
-

**Prerequisite**

Data Mining

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Apply the Fundamentals of business analytics | Apply |
| **CO2** | Analyze the various modeling techniques | Analyse |
| **CO3** | Apply the data analysis and delivery stages of business analytics | Apply |
| **CO4** | Illustrate the methods in business analytics | Apply |
| **CO5** | Analyze the appropriate techniques in business analytics | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 2 | 2 |
| **CO2** | 2 | 2 | 3 | 2 | 2 | 3 |
| **CO3** | 2 | 2 | 3 | 3 | 3 | 2 |
| **CO4** | 2 | 2 | 3 | 2 | 2 | 3 |
| **CO5** | 2 | 2 | 3 | 2 | 2 | 2 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 20 | 20 | 30 |
| Understand(Un) | 20 | 20 | 20 |
| Apply (Ap) | 10 | 20 | 30 |
| Analyze (An) | 10 | - | 20 |
| Evaluate(Ev) | - | - | - |
| Create(Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS 203 – Business Analytics** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence | [9] |
| **Knowledge Delivery**<br>The business intelligence user types, Standard reports, Interactive Analysis and Ad Hoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message | [9] |
| **Efficiency**<br>Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis | [9] |
| **Business Intelligence**<br>Marketing models – Logistic and Production models – Case studies. | [9] |
| **Future of Business Intelligence**<br>Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | Efraim Turban, Ramesh Sharda, Dursun Delen, '[Decision Support and Business Intelligence Systems', 9th Edition, Pearson 2013. |
| 2. | David Loshin Morgan, Kaufman, 'Business Intelligence: The Savvy Manager‟s Guide', 2nd Edition, 2012. |

**Reference(s):**

| | |
|---|---|
| 1. | Larissa T. Moss, S. Atre, 'Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making', Addison Wesley, 2003. |
| 2. | Carlo Vercellis, 'Business Intelligence: Data Mining and Optimization for Decision Making', Wiley Publications, 2009. |
| 3. | Cindi Howson, 'Successful Business Intelligence: Secrets to Making BI a Killer App', McGraw- Hill, 2007. |
| 4. | Ralph Kimball , Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, 'The Data Warehouse Lifecycle Toolkit', Wiley Publication Inc.,2007 |



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## Course Contents and Lecture Schedule

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction** | |
| 1.1 | Effective and timely decisions | 1 |
| 1.2 | Data, information and knowledge | 1 |
| 1.3 | Role of mathematical models | 1 |
| 1.4 | Business intelligence architecture Cycle of a business intelligence analysis | 1 |
| 1.5 | Cycle of a business intelligence analysis | 1 |
| 1.6 | Enabling factors in business intelligence projects | 1 |
| 1.7 | Development of a business intelligence system | 1 |
| 1.8 | Ethics | 1 |
| 1.9 | business intelligence | 1 |
| **2** | **Knowledge Delivery** | |
| 2.1 | The business intelligence user types | 1 |
| 2.2 | Standard reports | 1 |
| 2.3 | Interactive Analysis | 1 |
| 2.4 | Ad Hoc Querying | 1 |
| 2.5 | Parameterized Reports and Self-Service Reporting | 1 |
| 2.6 | dimensional analysis | 1 |
| 2.7 | Alerts/Notifications | 1 |
| 2.8 | Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, | 1 |
| 2.9 | Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message | 1 |
| **3** | **Efficiency** | |
| 3.1 | Efficiency measures | 1 |
| 3.2 | The CCR model: Definition of target objectives | 1 |
| 3.3 | Peer groups | 1 |
| 3.4 | Identification of good operating practices | 1 |
| 3.5 | Cross efficiency analysis | 1 |
| 3.6 | virtual inputs and outputs | 1 |
| 3.7 | Other models | 1 |
| 3.8 | Cluster analysis | 1 |
| 3.9 | Outlier analysis | 1 |
| **4** | **Business Intelligence** | |
| 4.1 | Marketing Models | 1 |
| 4.2 | Logistics and production models | 1 |
| 4.3 | Formal and Informal Models.. | 1 |
| 4.4 | Procurement Logistics | 1 |



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| | | |
|---|---|---|
| 4.5 | Production Logistics | 1 |
| 4.6 | Sales Logistics | 1 |
| 4.7 | Warehouse model | 1 |
| 4.8 | Fulfilment | 1 |
| 4.9 | Dropshipping | 1 |
| **5** | **Future of Business Intelligence** | |
| 5.1 | Future of business intelligence | 1 |
| 5.2 | Emerging Technologies | 1 |
| 5.3 | Machine Learning | 1 |
| 5.4 | Predicting the Future | 1 |
| 5.5 | BI Search | 1 |
| 5.6 | Text Analytics | 1 |
| 5.7 | Advanced Visualization | 1 |
| 5.8 | Rich Report | 1 |
| 5.9 | Future beyond Technology | 1 |
| | Total | 45 |

**Course Designers**

**Mr.M.Thilakraj (mthilakraj@ksrct.ac.in)**



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| 60 PDS 204 | Data Security and Privacy | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objective(s)

- To study different encryption techniques and attacks
- To learn Model Neuron and Neural Network, and to analyze ANN learning, and its applications
- To develop different single layer/multiple layer Perception learning algorithms
- To design of another class of layered networks using deep learning principles
- To analyze the different privacy preserving technology

## Prerequisite

Basic knowledge of Computer Networks, Cryptography and Network Security

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Compare different encryption techniques and attacks | Understand |
| **CO2** | Model Neuron and Neural Network, and to analyze ANN learning, and its applications | Apply |
| **CO3** | Develop different single layer/multiple layer Perception learning algorithms | Analyse |
| **CO4** | Design of another class of layered networks using deep learning principles | Apply |
| **CO5** | Analyze the different privacy preserving technology | Analyze |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO2** | 2 | 2 | 3 | 3 | 3 | 2 |
| **CO3** | 2 | 2 | 3 | 3 | 2 | 3 |
| **CO4** | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 2 | 2 | 3 | 2 | 3 | 2 |

**3-Strong; 2-Medium; 1-Some**

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 00 | 00 | 00 |
| Understand (Un) | 30 | 00 | 30 |
| Apply (Ap) | 30 | 30 | 60 |
| Analyze (An) | 00 | 30 | 30 |
| Evaluate(Ev) | 00 | 00 | 00 |
| Create (Cr) | 00 | 00 | 00 |



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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PDS 204 - Data Security and Privacy** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| **II** | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Data Security Fundamentals**<br>Computer Security Concepts, IntrusionDetection, Firewalls: Characteristics,Types.Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack,Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Polyalphabetic Cipher, One Time Pad.Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the Feistel Cipher<br>Structure, the Feistel Cipher. | [9] |
| **Public-Key Cryptography**<br>Principles of Public-key Cryptosystems, Public-Key Cryptosystems, Applications for Public-Key Cryptosystems, Requirements for Public-Key Cryptosystems. Public-Key Cryptanalysis. The RSA Algorithm, Description of the Algorithm, Computational Aspects, the Security of RSA. Other Public-Key Cryptosystems:Diffe-Hellman Key Exchange, The Algorithm, Key exchange protocols, Man-in-the-Middle Attack, Simple secret key distribution, Secretkey distribution with confidentiality and authentication, A hybrid scheme.Public keys certificates, X.509certificates. Public key infrastructure, PKIXManagement Functions, PKIX Management Protocols. | [9] |
| **Authentication and Authorization**<br>Authentication Vs Authorization, Authentication Methods –Password authentication, Public Key Cryptography, Biometric authentication, Out of band, Authentication Protocols – SSL, Password Authentication Protocol (PAP), Kerberos, Email authentication,- PGP, Database authentication, Message authentication; secure hash functions and Authorization Approaches to hmac; publickey cryptography principles; public-key cryptography algorithms, digital signatures, key management. Kerberos, x.509 directory authentication service. Authorization Definition, Multilayer authorization, | [9] |
| **Data Privacy and Anonymization**<br>**Understanding Privacy:** Social Aspects of Privacy Legal Aspects of Privacy and Privacy Regulations Effect of Database and Data Mining technologies on privacy challenges raised by new emerging technologies such RFID, biometrics, etc., Privacy Models Introduction to Anonymization,<br>Anonymization models:K-anonymity, l-diversity, t-closeness, differentialprivacy Database as aservice | [9] |
| **Data Privacy for Data Science**<br>**Using technology for preserving privacy**. Statistical Database security Inference Control Secure Multi-party computation and Cryptography Privacy-preserving Data mining Hippocratic databases<br>**Emerging Applications:** Social Network Privacy, Location Privacy, Query Log Privacy, Biomedical Privacy | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | William Stallings, Cryptography and Network Security: Principles and Practice William Stallings, Seventh Edition, Pearson Education, 2017. |
| 2. | Cynthia Dwork and Aaron Roth, The Algorithmic Foundations of Differential Privacy, Vol. 9, Nos. 3 - 4, DOI: 10.1561 / 0400000042, 2014. |
| **Reference(s):** | |
| 1. | Claire McKay Bowen, Introduction to Anonymization, https://s3.amazonaws.com/assets.datacamp.com/production/course_6412/slides/chapter1.pdf |
| 2. | Charu C. Aggarwal. and Philip S. Yu, Privacy-Preserving Data Mining: Models and Algorithms, 1st Edition, Springer, 2010. |
| 3. | Michael E. Whitman and Herbert J. Mattord, Principles of Information Security, 6th Edition, Cengage Learning, 2018. |
| 4. | Balaji Raghunathan, The Complete Book of Data Anonymization: From Planning to Implementation, Second Edition, Auerbach Publishers, Incorporated, 2013. |

**Course Contents and Lecture Schedule**

Rev. No.3/w.e.f. 22.07.2024 Approved Passed in BoS Meeting held on 24/05/2024in Academic Council Meeting held on 25/05/2024

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| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Data Security Fundamentals** | |
| 1.1 | Computer Security Concepts, Intrusion Detection | 1 |
| 1.2 | Firewalls: Characteristics, Types | 1 |
| 1.3 | Classical Encryption Techniques Symmetric Cipher Model, Cryptography | 1 |
| 1.4 | Cryptanalysis and Brute-Force Attack | 1 |
| 1.5 | Substitution Techniques, Caesar Cipher | 1 |
| 1.6 | Monoalphabetic Cipher, Polyalphabetic Cipher, One Time Pad | 1 |
| 1.7 | Block Ciphers and the data encryption standard: Traditional block Cipher structure | 1 |
| 1.8 | Stream Ciphers and Block Ciphers | 1 |
| 1.9 | Motivation for the Feistel Cipher structure, the Feistel Cipher. | 1 |
| **2** | **Public-Key Cryptography** | |
| 2.1 | Principles of Public-key Cryptosystems, Public-Key Cryptosystems, Applications for Public-Key Cryptosystems. | 1 |
| 2.2 | Requirements for Public-Key Cryptosystems. Public-Key Cryptanalysis. | 1 |
| 2.3 | The RSA Algorithm, Description of the Algorithm. | 1 |
| 2.4 | Computational Aspects, the Security of RSA. | 1 |
| 2.5 | Other Public-Key Cryptosystems: Diffe-Hellman Key Exchange, The Algorithm, Key exchange protocols, Man-in-the-Middle Attack. | 1 |
| 2.6 | Simple secret key distribution, Secret key distribution with confidentiality and authentication, A hybrid scheme. | 1 |
| 2.7 | Public keys certificates. | 1 |
| 2.8 | X.509 certificates. | 1 |
| 2.9 | Public key infrastructure, PKIX Management Functions, PKIX Management Protocols. | 1 |
| **3** | **Authentication and Authorization** | |
| 3.1 | Authentication Vs Authorization, Authentication Methods –Password authentication, Public Key Cryptography | 1 |
| 3.2 | Biometric authentication, Out of band | 1 |
| 3.3 | Authentication Protocols – SSL | 1 |
| 3.4 | Password Authentication Protocol (PAP) | 1 |
| 3.5 | Kerberos, Email authentication | 1 |
| 3.6 | PGP, Database authentication | 1 |
| 3.7 | Message authentication, Secure hash functions and Authorization Approaches to hmac; public key cryptography principles; | 1 |
| 3.8 | Public-key cryptography algorithms, digital signatures, key management. | 1 |
| 3.9 | X.509 directory authentication service. Authorization Definition, Multilayer authorization. | 1 |
| **4** | **Data Privacy and Anonymization** | |
| 4.1 | Data Privacy And Anonymization Understanding Privacy: Social Aspects of Privacy | 1 |
| 4.2 | Legal Aspects of Privacy and Privacy Regulations | 1 |



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| | | |
|---|---|---|
| 4.3 | Effect of Database and Data Mining technologies on privacy | 1 |
| 4.4 | Challenges raised by new emerging technologies such RFID, biometrics, etc., | 1 |
| 4.5 | Privacy Models, Introduction to Anonymization models | 1 |
| 4.6 | K-anonymity | 1 |
| 4.7 | l-diversity, t-closeness | 1 |
| 4.8 | Differential privacy and Extensions | 1 |
| 4.9 | Database as a service | 1 |
| **5** | **Data Privacy for Data Science** | |
| 5.1 | Using technology for preserving privacy. Statistical Database security | 1 |
| 5.2 | Inference Control | 1 |
| 5.3 | Secure Multi-party computation and Cryptography | 1 |
| 5.4 | Privacy-preserving Data mining | 1 |
| 5.5 | Hippocratic databases | 1 |
| 5.6 | Emerging Applications: Social Network Privacy | 1 |
| 5.7 | Location Privacy | 1 |
| 5.8 | Query Log Privacy | 1 |
| 5.9 | Biomedical Privacy | 1 |
| | Total | 45 |

**Course Designers**

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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PDS 2P1 - Term Paper and Seminar** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 0 | 0 | 2 | 30 | 0 | 100 | 00 | 100 |

| | |
|---|---|
| **Objective(s)** | • To develop scientific and technical reading and writing skills that they need to Understand and construct research articles.<br>• To obtain information from a variety of sources (i.e Journals, dictionaries, reference books) and then place it in logically developed ideas.<br>• To identify the recent topics in the research area and formulate the problem<br>• To analyze the mathematical model for the identified problem<br>• To design and simulate/ develop prototype model |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Survey the relevant bibliography such as national/international referred journals forthe preferred areas of research<br>CO2: Develop scientific, technical reading and writing skills for the technical report preparation to apply it in their topics of research<br>CO3: Apply mathematical ideas to any problem in the research field<br>CO4: Implement and analyze the various complex problems in different practical applications<br>CO5: Cultivate presentation skills to deliver their work in front of technically qualified audience |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **The work involves the following steps:**<br>1. Selecting a subject, narrowing the subject into a topic.<br>2. Stating an objective.<br>3. Collecting the relevant bibliography (at least 15 journal papers)<br>4. Preparing a working outline.<br>5. Studying the papers and understanding the authors contributions and critically analysing each paper.<br>6. Preparing a working outline.<br>7. Linking the papers and preparing a draft of the paper.<br>8. Preparing conclusions based on the reading of all the papers.<br>9. Writing the Final Paper and giving final Presentation<br>Please keep a file where the work carried out by you is maintained.<br>Activities to be carried out | [9] |

| **Activity** | **Instructions** | **Submission week** | **Evaluation** |
|---|---|---|---|
| Selection of area of interest and Topic<br>Stating an Objective | An area of interest, topic has to be selected and objective to be framed | 2nd week | 3 % Based on clarity of thought, current relevance and clarity in writing |
| Collecting Information about chosen area & topic | 1.List 1 Special Interest Groups or professional society<br>2.List 2 journals<br>3.List 3 conferences, symposia or workshops<br>4. List 1 thesis title<br>5. List 5 web presences (mailing lists, forums, News sites)<br>6. List 6 authors who publish regularly in your area<br>7. Attach a call for papers (CFP) from your area.<br>8. Conference/Journal/Symposium in the chosen area. | 3rd week | 3% ( the selected information must be area specific and of international and national standard) |
| Collection of Journal papers in the topic in the context of the | • Provide a complete list of references you will be using- Based on the objective -Search various digital libraries and Google Scholar | 4th week | 6% ( the list of standard papers and reason for |



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| | | | |
|---|---|---|---|
| objective – collect 20 & then filter | • When picking papers to read – try to:<br>• Pick papers that are related to each other in some ways and/or that are in the same field so that a meaningful survey can be written<br>• Favour papers from well-known journals And conferences,<br>• Favour—firstll or foundationalll papers in the field (as indicated in other people's survey paper),Favour more recent papers,<br>• Pick a recent survey of the field so you can quickly gain anoverview,<br>• Find relationships with respect to each other and to your topic area (classification scheme/categorization)<br>• Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered | | selection) |
| Reading and notes for first 5 papers | Reading Paper Process<br>• For each paper form aTable answering the following questions:<br>• What is the main topic of thearticle?<br>• What was/were the main issue(s) the author said they want to discuss?<br>• Why did the author claim it was important?<br>• How does the work build on other's work, in the author'sopinion?<br>• What simplifying assumptions does the author claim to bemaking?<br>• What did the authordo?<br>• How did the author claim they were going to evaluate their work and compare it toothers?<br>• What did the author say were the limitations of their research?<br>• What did the author say were the important directions for future research?<br>Conclude with limitations/issues not addressed by the paper ( from the perspective of your survey) | 5th week | 8% ( the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |
| Reading and notes for next5 papers | Repeat Reading Paper Process | 6th week | 8%( the table given should indicate your understanding of the paper and the evaluation isbased on your conclusions about eachpaper) |
| Reading and notes for final 5 papers | Repeat Reading Paper Process | 7th week | **8%**( the table given should indicate your understanding of the paper and the evaluation is based on your |



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| | | | |
|---|---|---|---|
| | | | conclusions about each paper) |
| Draft outline 1 and Linking papers | Prepare a draft Outline, your survey goals, along with a classification / categorization diagram | 8th week | **8%**( this component will be evaluated based on the linking and classification among the papers) |
| Abstract | Prepare a draft abstract and give a presentation | 9th week | **6%**(Clarity, purpose and conclusion)<br>**6%** resentation & Viva Voce |
| Introduction Background | Write an introduction and background sections | 10th week | **5%** ( clarity) |
| Sections of the paper | Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey | 11thweek | **10%**<br>(this component will be evaluated based on the linking and classification among the papers) |
| Conclusions | Write your conclusions and future work | 12th week | **5%** (conclusions – clarity and your ideas) |
| Final Draft | Complete the final draft of your paper | 13th week | **10%** (formatting, English, Clarity and linking)<br>**4%** Plagiarism Check Report |
| Seminar | A brief 15 slides on your paper | 14th& 15th week | **10%**<br>(based on presentation and Viva-voce) |



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| 60 PDS 2P2 | Exploratory Data Analysis Laboratory | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 0 | 0 | 4 | 2 |

**Objective(s)**

- To optimize business decisions and create competitive advantage with Big Data analytics.
- To impart the architectural concepts of Hadoop and introducing map reduce paradigm.
- To introduce Java concepts required for developing map reduce programs and derive business benefit from unstructured data.
- To introduce programming tools PIG & HIVE in Hadoop echo system.
- To develop Big Data applications for streaming data using Apache Spark.

**Prerequisite**

Basic knowledge of Data mining and machine learning techniques.

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Prepare for data summarization, query and analysis | Apply |
| **CO2** | Apply data modelling techniques to large data sets | Apply |
| **CO3** | Install Hadoop and write MapReduce Programs | Apply |
| **CO4** | Create applications for Big Data analytics | Apply |
| **CO5** | Build a complete business data analytic solution | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 2 | 2 | 3 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 3 | 2 | 2 | 2 | 2 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 |
| **3-Strong; 2-Medium; 1-Some** | | | | | | |

**Assessment Pattern**

| Bloom's Category | Lab Experiments Assessment (Marks) | | Model Examination (Marks) | End Sem Examination (Marks) |
|---|---|---|---|---|
| | Lab | Activity | | |
| Remember | - | - | - | - |
| Understand | - | - | - | - |
| Apply | 40 | 15 | 80 | 80 |
| Analyse | 10 | 10 | 20 | 20 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |
| Total | 50 | 25 | 100 | 100 |



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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PDS 2P2 - Exploratory Data Analysis Laboratory** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 0 | 0 | 4 | 60 | 2 | 60 | 40 | 100 |

Lab Exercises:

1. (i)Perform setting up and Installing Hadoop in its two operating modes:
   - Pseudo distributed,
   - Fully distributed.

(ii) Use web based tools to monitor Hadoop setup.

2. (i) Implement the following file management tasks in Hadoop:
   - Adding files and directories
   - Retrieving files
   - Deleting files

ii) Benchmark and stress test an Apache Hadoop cluster

3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
   - Find the number of occurrence of each word appearing in the input file(s)
   - Performing a MapReduce Job for word search count (look for specific keywordsin a file)
4. Stop word elimination problem:
   - Input:
   - A large textual file containing one sentence per line
   - A small file containing a set of stop words (One stop word per line)
   - Output:
   - A textual file containing the same sentences of the large input file without thewords appearing in the small file.
5. Write a Map Reduce program that mines weather data. Weather sensors collectingdata every hour at many locations across the globe gather large volume of log data, Data available at: https://github.com/tomwhite/hadoopbook/tree/master/input/ncdc/all.
   - Find average, max and min temperature for each year in NCDC data set?
   - Filter the readings of a set based on value of the measurement, Output the lineof input files associated with a temperature value greater than 30.0 and store itin a separate file.
6. Purchases.txt Dataset
   - Instead of breaking the sales down by store, give us a sales breakdown byproduct category across all of our stores
   - What is the value of total sales for the following categories?
   - Toys
   - ➢ Consumer Electronics
   - ➢ Find the monetary value for the highest individual sale for each separate store
   - What are the values for the following stores?
   - ➢ Reno
   - ➢ Toledo
   - ➢ Chandler
   - ➢ Find the total sales value across all the stores, and the total number of sales.
7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter data.
8. Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available at: Project Gutenberg)
9. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.
10. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.
11. Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.
    - ➢ Write a single Spark application that:
    - Transposes the original Amazon food dataset, obtaining a PairRDD of the type: <user_id> → <list of the product_ids reviewed by user_id>
    - Counts the frequencies of all the pairs of products reviewed together; Writes on the output folder all the pairs of products that appear more than onceand their frequencies. The pairs of products must be sorted by frequency.

**Course Designers**

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| 60 PDS E11 | Artificial Intelligence and Internet of Things | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To present an overview of artificial intelligence (AI) principles and approaches
- To develop a basic understanding of the building blocks of AI
- To implement a small AI system in a team environment.
- To provide the students with understanding of Internet of Things (IoT).
- To learn about various IOT-related protocols

**Prerequisite**

Basic knowledge of Artificial Intelligence, Big Data.

Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Understand the various characteristics of Intelligent agents. | Understand |
| **CO2** | Learn the different search strategies in AI. | Analyse |
| **CO3** | Learn to represent knowledge in solving AI problems. | Apply |
| **CO4** | Explain the concept of IoT. | Understand |
| **CO5** | Analyze various protocols for IoT. | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 3 | 2 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 3 | 3 | 3 | 3 |

**3- Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 00 | 00 | 00 |
| Understand (Un) | 25 | 15 | 30 |
| Apply (Ap) | 20 | 30 | 40 |
| Analyse(An) | 00 | 00 | 00 |
| Evaluate(Ev) | 15 | 15 | 30 |
| Create (Cr) | 00 | 00 | 00 |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS E11 - Artificial Intelligence and Internet of Things** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Introduction–Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems. | [9] |
| **Problem Solving Methods**<br>Problem solving Methods – Search Strategies- Uninformed – Informed – Heuristics – Local Search Algorithms and Optimization Problems – Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning – Stochastic Games | [9] |
| **Knowledge Representation**<br>First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories –Reasoning with Default Information. | [9] |
| **Fundamentals of IoT**<br>Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects | [9] |
| **IoT Protocols**<br>IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT. | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | S. Russell and P. Norvig, 'Artificial Intelligence: A Modern Approachǁ, Prentice Hall', 3rd Edition, 2009. |
| 2. | David Hanes, 'Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry', —IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017. |
| **Reference(s):** | |
| 1. | M. Tim Jones, — 'Artificial Intelligence: A Systems Approach(Computer Science)', Jones and Bartlett Publishers, Inc.; 1st Edition, 2008 |
| 2. | Nils J. Nilsson, —'The Quest for Artificial Intelligencell', Cambridge University Press, 2009. |
| 3. | ArshdeepBahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015. |
| 4. | Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2). |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction** | |
| 1.1 | Introduction | 1 |
| 1.2 | Definition | 1 |
| 1.3 | Future of Artificial Intelligence | 2 |
| 1.4 | Characteristics of Intelligent Agents | 2 |
| 1.5 | Typical Intelligent Agents | 2 |
| 1.6 | Problem Solving Approach to Typical AI problems | 1 |
| **2** | **Problem Solving Methods** | |
| 2.1 | Problem solving Methods | 1 |
| 2.2 | Search Strategies- Uninformed – Informed | 1 |
| 2.3 | Heuristics – Local Search Algorithms and Optimization Problems | 1 |
| 2.4 | Searching with Partial Observations | 1 |
| 2.5 | Constraint Satisfaction Problems | 1 |
| 2.6 | Constraint Propagation – Backtracking Search | 1 |
| 2.7 | Game Playing – Optimal Decisions in Games | 1 |
| 2.8 | Alpha – Beta Pruning | 1 |
| 2.9 | Stochastic Games | 1 |
| **3** | **Knowledge Representation** | 1 |
| 3.1 | First Order Predicate Logic | 1 |
| 3.2 | Prolog Programming – Unification | 1 |
| 3.3 | Forward Chaining-Backward Chaining | 1 |
| 3.4 | Resolution – Knowledge Representation | 1 |
| 3.5 | Ontological Engineering | 1 |
| 3.6 | Categories and Objects | 1 |
| 3.7 | Events – Mental Events and Mental Objects | 1 |
| 3.8 | Reasoning Systems for Categories | 1 |
| 3.9 | Reasoning with Default Information | 1 |
| **4** | **Fundamentals of IoT** | 1 |
| 4.1 | Evolution of Internet of Things | 1 |
| 4.2 | Enabling Technologies | 1 |
| 4.3 | IoT Architectures: oneM2M | 1 |
| 4.4 | IoT World Forum (IoTWF) and Alternative IoT models | 1 |
| 4.5 | Simplified IoT Architecture and Core IoT Functional Stack | 1 |
| 4.6 | Fog, Edge and Cloud in IoT | 1 |
| 4.7 | Functional blocks of an IoT ecosystem | 1 |
| 4.8 | Sensors, Actuators, Smart Objects | 1 |
| 4.9 | Connecting Smart Objects | 1 |
| **5** | **IoT Protocols** | 1 |
| 5.1 | IoT Access Technologies: Physical and MAC layers | 1 |
| 5.2 | Topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN | 1 |
| 5.3 | Network Layer: IP versions | 1 |
| 5.4 | Constrained Nodes and Constrained Networks | 1 |
| 5.5 | Optimizing IP for IoT: From 6LoWPAN to 6Lo | 1 |
| 5.6 | Routing over Low Power and Lossy Networks | 1 |
| 5.7 | Application Transport Methods: Supervisory Control and Data Acquisition | 1 |
| 5.8 | Application Layer Protocols: CoAP and MQTT | 2 |
| | Total | 45 |

**Course Designers**

**S.Gayathri-gayathris@ksrct.ac.in**

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| 60 PDS E12 | Soft Computing and its Applications | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To understand Soft Computing concepts, technologies, and applications
- To know the underlying principle of soft computing with its usage in various application.
- To compare different genetic algorithms
- To analyze supervised and unsupervised learning algorithms
- To understand different soft computing tools for solving real life problems.

**Prerequisite**

Basic knowledge of Neural Network, and Deep Learning

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Know soft computing basics | Analyse |
| **CO2** | Develop application on different soft computing techniques like Fuzzy logic and its applications. | Apply |
| **CO3** | Solve single-objective optimization problems using Gas | Apply |
| **CO4** | Compare artificial neural networks and its applications | Apply |
| **CO5** | Apply Soft computing to solve problems in various application domains. | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 2 | 3 | 3 |
| **CO2** | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO3** | 2 | 2 | 3 | 2 | 2 | 2 |
| **CO4** | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 2 | 2 | 3 | 3 | 3 | 3 |
| **3-Strong; 2-Medium; 1-Some** | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 10 | 10 | - |
| Understand (Un) | 20 | 20 | 20 |
| Apply (Ap) | 20 | 30 | 40 |
| Analyze (An) | 10 | - | 40 |
| Evaluate(Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS E12 - Soft Computing and its Applications** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Soft Computing**<br>Concept of computing systems - "Soft" computing versus "Hard" computing - Characteristics of Soft computing - Some applications of Soft computing techniques | [9] |
| **Fuzzy logic**<br>Introduction to Fuzzy logic - Fuzzy sets and membership functions - Operations on Fuzzy sets - Fuzzy relations, rules, propositions, implications and inferences - Defuzzification techniques - Fuzzy logic controller design - Some applications of Fuzzy logic | [9] |
| **Genetic Algorithms**<br>Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques - Basic GA framework and different GA architectures - GA operators: Encoding, Crossover, Selection, Mutation - Solving single - objective optimization problems using Gas | [9] |
| **Artificial Neural Networks**<br>Supervised Learning: Introduction and how brain works, Neuron as a simple computing element, The perceptron, Back propagation networks: architecture, multilayer perceptron, backpropagation learning-input layer, accelerated learning in multilayer perceptron - Unsupervised Learning: Hebbian Learning, Generalized Hebbian learning algorithm, Competitive learning, Self- Organizing Computational Maps: Kohonen Network. | [9] |
| **Hybrid Systems:**<br>Sequential Hybrid Systems, Auxiliary Hybrid Systems - Embedded Hybrid Systems - Neuro-Fuzzy Hybrid Systems, Neuro - Genetic Hybrid Systems - Fuzzy - Genetic Hybrid Systems | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | Randy L. Haupt and sue Ellen Haupt,' Practical Genetic Algorithms' John Willey & Sons, 2002. |
| 2. | Neural Networks and Learning Machines, 3rd Edition, Simon Haykin, PHI Learning, 2011. |
| **Reference(s):** | |
| 1. | Fuzzy Logic with Engineering Applications 3rd Edition, Timothy J. Ross, Willey, 2010. |
| 2. | An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000. |
| 3. | Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002. |
| 4. | https://archive.nptel.ac.in/courses/106/105/106105173/ |



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**Course Content and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction to Soft Computing** | |
| 1.1 | Introduction | 1 |
| 1.2 | Concept of computing | 1 |
| 1.3 | systems | 1 |
| 1.4 | "Soft" computing versus "Hard" computing | 1 |
| 1.5 | Characteristics of Soft | 1 |
| 1.6 | computing | 1 |
| 1.7 | Some applications of Soft computing techniques | 1 |
| 1.8 | Soft computing | 1 |
| 1.9 | Hard computing | 1 |
| **2** | **Fuzzy logic** | |
| 2.1 | Introduction to Fuzzy logic | 1 |
| 2.2 | Fuzzy sets and membership functions | 1 |
| 2.3 | Operations on Fuzzy sets | 1 |
| 2.4 | Fuzzy relations, rules, | 1 |
| 2.5 | propositions, implications and inferences | 1 |
| 2.6 | Defuzzification techniques | 1 |
| 2.7 | Fuzzy logic controller design | 1 |
| 2.8 | Some applications of Fuzzy logic | 1 |
| 2.9 | Some applications of Fuzzy logic | 1 |
| **3** | **Genetic Algorithms** | |
| 3.1 | Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques | 1 |
| 3.2 | Basic GA framework and different GA architectures | 1 |
| 3.3 | GA operators: | 1 |
| 3.4 | Encoding | 1 |
| 3.5 | Crossover | 1 |
| 3.6 | Selection | 1 |
| 3.7 | Mutation | 1 |
| 3.8 | Solving single | 1 |
| 3.9 | objective optimization problems using Gas | 1 |
| **4** | **Artificial Neural Networks** | |
| 4.1 | Supervised Learning | 1 |
| 4.2 | Introduction and how brain works | 1 |
| 4.3 | Neuron as a simple computing element | 1 |
| 4.4 | The perceptron, Back propagation networks | 1 |
| 4.5 | architecture, multilayer perceptron, backpropagation learning | 1 |
| 4.6 | Input layer, accelerated learning in multilayer perceptron | 1 |

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| | | |
|---|---|---|
| 4.7 | Unsupervised Learning: Hebbian Learning, | 1 |
| 4.8 | Generalized Hebbian learning algorithm, Competitive learning, | 1 |
| 4.9 | Self- Organizing Computational Maps: Kohonen Network. | 1 |
| **5** | **Hybrid Systems** | |
| 5.1 | Sequential Hybrid Systems | 1 |
| 5.2 | Auxiliary Hybrid Systems | 1 |
| 5.3 | Embedded Hybrid Systems | 1 |
| 5.4 | Neuro-Fuzzy Hybrid Systems | 1 |
| 5.5 | Neuro - Genetic Hybrid Systems | 1 |
| 5.6 | Neuro - Genetic Hybrid Systems | 1 |
| 5.7 | Fuzzy - Genetic Hybrid Systems | 1 |
| 5.8 | Embedded Hybrid Systems | 1 |
| 5.9 | Fuzzy - Genetic Hybrid Systems | 1 |
| | Total | 45 |

**Course Designers**

**Mr.P.Dineshkumar (p.dineshkumar@ksrct.ac.in)**



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| 60 PDS E13 | Data Mining and Applications | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To Identify the scope and necessity of Data Mining algorithms.
- To Underst and the fundamentals of data mining and its functionalities.
- To Realize the issues regarding classification and prediction.
- To understand various tools of Data Mining and their techniques to solve the real time problems.
- To acquire skills to understanding the concepts of Spatial Mining

**Prerequisite**

Basic knowledge of Neural Network, and Deep Learning

**Course Outcomes**

**On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| **CO1** | Classify the diverse attributes in data mining | Analyse |
| **CO2** | Analyze decision tree algorithm for classification | Apply |
| **CO3** | Apply various clustering algorithms for different datasets | Apply |
| **CO4** | Analyze the concepts of rule mining and visualization | Apply |
| **CO5** | Apply the concepts of Web, Temporal and spatial data mining | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 3 | 3 |
| **CO2** | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO3** | 2 | 2 | 3 | 2 | 2 | 2 |
| **CO4** | 2 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 10 | 10 | - |
| Understand (Un) | 20 | 20 | 20 |
| Apply (Ap) | 20 | 30 | 40 |
| Analyse (An) | 10 | - | 40 |
| Evaluate(Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS E13 - Data Mining and Applications** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Data Mining**<br>Definition of Data Mining-Kind of Data-Data Mining Functionalities-Kinds of Patterns-Classification of Data Mining Systems-Data Mining Task Primitives-Integration of A Data Mining System With A Database- Major Issues In Data Mining-Types of Data Sets and Attribute Values-Basic Statistical Descriptions of Data- Data Visualization- Measuring Data Similarity. PREPROCESSING: Data Quality- Major Tasks in Data Preprocessing- Data Reduction-DataTransformation and Data Discretization- Data Cleaning and Data Integration. | [9] |
| **Classification**<br>Classification -Classification by Decision Tree Introduction- Bayesian Classification-Rule Based Classification -Classification by Back propagation-Support Vector Machines -Associative Classification, Classification Using Frequent Patterns - k-Nearest-Neighbor Classifiers - Case-Based Reasoning-Multiclass Classification - Semi-Supervised Classification- Mining Time series Data-Periodicity Analysis for time related sequence data | [9] |
| **Clustering Analysis**<br>Cluster Analysis: Types of Data in Cluster Analysis-A Categorization of Major Clustering Methods-Partitioning Methods-Hierarchical methods-Density Based Methods-Grid Based Methods-Model Based Clustering Methods-Clustering HighDimensional Data-ConstraintBased Cluster Analysis, Outlier Analysis-Distribution Based Outlier Detection - A Statistics Based Approach-Classification Based Outlier Detection-Clustering Based Outlier Detection-Deviation Based Outlier Detection. | [9] |
| **Association Rule Mining and Visualization**<br>Association Rule Mining – Introduction – Large Item sets – Basic Algorithms – Parallel and Distributed Algorithms – Comparing Approaches – Incremental Rules – Advanced Association Rule Techniques – Measuring the Quality of Rules – Visualization of Multidimensional Data – Diagrams for Multidimensional visualization – Visual Data Mining – Data Mining Applications | [9] |
| **Web, Text, Temporal and Spatial Data Mining**<br>Multidimensional Analysis and Descriptive Mining of Complex Data Objects-Introduction, webmining, webcontent mining, web structure mining, we usage mining, Text mining, unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.<br>Introduction; Temporal Data Mining , Temporal Association Rules, Sequence Mining, GSP algorithm,SPADE,SPIRIT Episode Discovery, Time Series Analysis, Spatial Mining, Spatial Mining Tasks,Spatial Clustering.Data Mining Applications. | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | Jiawei Han and MichelineKamber 'Data Mining Concepts and Techniques'2nd Edition, Elsevier, Reprinted 2008. |
| 2. | Pang-Ning Tan, 'Michael Steinbach and Vipin Kumar "Introduction to Data Mining', Pearson Education, 2007. |
| **Reference(s):** | |
| 1. | Ian H. 'Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques' 4th Edition, Morgan Kaufmann, 2016 |
| 2. | Jiawei Han, MichelineKamber, Jian Pei, 'Data Mining Concepts and Techniques', Morgan Kaufman Publications, 3rd Edition, 2011 |
| 3. | Nathan Marz, Samuel E. Ritchie 'Big Data Principles and best practices of scalable real time data systems' ", Manning Publications Company, 2013 |
| 4. | Alex Berson and Stephen J. Smith 'Data Warehousing, Data Mining & OLAP', Tata McGraw Hill Edition, Tenth Reprint 2007. |

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## Course Contents and Lecture Schedule

| S.No | Topic | No. of Hours |
|---|---|---|
| **1** | **Introduction to Data Mining** | 1 |
| 1.1 | Definition of Data Mining-Kind of Data-Data Mining Functionalities-Kinds of Patterns | 1 |
| 1.2 | Classification of Data Mining Systems-Data Mining Task Primitives | 1 |
| 1.3 | Integration of A Data Mining System With A Database | 1 |
| 1.4 | Major Issues In Data Mining-Types of Data Sets and Attribute Values | 1 |
| 1.5 | Basic Statistical Descriptions of Data- Data Visualization- Measuring Data Similarity | 1 |
| 1.6 | PREPROCESSING: Data Quality- Major Tasks in Data Preprocessing | 1 |
| 1.7 | Data Reduction | 1 |
| 1.8 | Data Transformation and Data Discretization | 1 |
| 1.9 | Data Cleaning and Data Integration | 1 |
| **2** | **Classification** | |
| 2.1 | Classification -Classification by Decision Tree Introduction | 1 |
| 2.2 | Bayesian Classification-Rule Based Classification -Classification by Back propagation | 2 |
| 2.3 | Support Vector Machines -Associative Classification | 1 |
| 2.4 | Classification Using Frequent Patterns - k-Nearest-Neighbor Classifiers | 1 |
| 2.5 | Case-Based Reasoning- Multiclass Classification | 1 |
| 2.6 | Semi-Supervised Classification | 1 |
| 2.7 | Mining Time series Data | 1 |
| 2.8 | Periodicity Analysis for time related sequence data | 1 |
| **3** | **Clustering Analysis** | |
| 3.1 | Cluster Analysis: Types of Data in Cluster Analysis-A Categorization of Major Clustering Methods | 1 |
| 3.2 | Partitioning Methods-Hierarchical Methods-Density Based Methods | 1 |
| 3.3 | Grid Based Methods-Model Based Clustering Methods | 1 |
| 3.4 | Clustering High Dimensional Data-Constraint Based Cluster Analysis | 1 |
| 3.5 | Outlier Analysis- Distribution Based Outlier Detection | 1 |
| 3.6 | A Statistics Based Approach | 1 |
| 3.7 | Classification Based Outlier Detection | 1 |
| 3.8 | Clustering Based Outlier Detection | 1 |
| 3.9 | Deviation Based Outlier Detection | 1 |
| **4** | **Association Rule Mining and Visualization** | |
| 4.1 | Association Rule Mining – Introduction – Large Item sets | 1 |
| 4.2 | Basic Algorithms – Parallel and Distributed Algorithms | 1 |
| 4.3 | Comparing Approaches- Incremental Rules | 1 |
| 4.4 | Advanced Association Rule Techniques | 1 |
| 4.5 | Measuring the Quality of Rules | 1 |
| 4.6 | Visualization of Multidimensional Data | 1 |
| 4.7 | Diagrams for Multidimensional visualization | 1 |
| 4.8 | Visual Data Mining | 1 |
| 4.9 | Data Mining Applications | 1 |
| **5** | **Web, Text, Temporal and Spatial Data Mining** | |
| 5.1 | Multidimensional Analysis and Descriptive Mining of Complex Data Objects | 1 |
| 5.2 | Introduction, web mining, webcontent mining, web structure mining, | 1 |
| 5.3 | we usage mining, Text mining, unstructured text, | 1 |
| 5.4 | Episode rule discovery for texts, hierarchy of categories, text clustering | 1 |
| 5.5 | Introduction; Temporal Data Mining, Temporal Association Rules | 1 |
| 5.6 | Sequence Mining, GSP algorithm, SPADE | 1 |
| 5.7 | SPIRIT Episode Discovery, Time Series Analysis | 1 |
| 5.8 | Spatial Mining, Spatial Mining Tasks | 1 |
| 5.9 | Spatial Clustering. Data Mining Applications | 1 |

## Course Designers

**Mr.S.Raja (rajas@ksrct.ac.in)**

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| 60 PDS E14 | Distributed Systems | Category | L | | T | P | Credit |
|---|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 | 3 |

**Objective(s)**

- To learn the principles, architectures, algorithms and programming models used in distributed systems.
- To examine the message ordering and group communication of distributed systems
- To gain knowledge of distributed mutual exclusion and deadlock detection algorithms
- To understand the significance of agreement, fault tolerance and recovery protocols in distributed systems
- To learn the characteristics of peer-to-peer and distributed shared memory systems

**Prerequisite**

Basic knowledge of Operating System, Computer Networks

**Course Outcomes**

On the successful completion of the course,students will be able to

| | | |
|---|---|---|
| **CO1** | Understand the principles, architectures, algorithms and programming models used in distributed systems. | Remember |
| **CO2** | Learn issues related to clock Synchronization and the need for global state indistributed systems | Analyse |
| **CO3** | Design and implement distributed mutex and deadlock detection algorithms | Apply |
| **CO4** | Design and implement the significance of agreement, fault tolerance and recovery protocols in distributed Systems | Apply |
| **CO5** | Learn the characteristics of peer-to-peer and distributed shared memory systems | Understand |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 2 | 3 | 2 | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 |
| **3-Strong; 2-Medium; 1-Some** | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 10 | 10 | - |
| Understand (Un) | 20 | 20 | 20 |
| Apply (Ap) | 20 | 30 | 40 |
| Analyze (An) | 10 | - | 40 |
| Evaluate(Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS E14 - Distributed Systems** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| Introduction<br>Introduction: Definition –Relation to computer system components –Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication –Synchronous versus asynchronous executions –Design issues and challenges. A model of distributed computations: A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts –Past and future cones of an event –Models of process communications | [9] |
| Message ordering&Snapshots<br>Message ordering and group communication: Message ordering paradigms –Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system –Group communication – Causal order (CO) – Total order. Global state and snapshot recording algorithms: Introduction –System model and definitions –Snapshot algorithms for FIFO channels | [9] |
| Distributed mutex & Deadlock<br>Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport‘s algorithm –Ricart-Agrawala algorithm – Maekawa‘s algorithm – Suzuki–Kasami‘s broadcast algorithm. Deadlock detection in distributed systems: Introduction – System model – Preliminaries –Models of deadlocks – Knapp‘s classification –Algorithms for the single resource model, the AND model and the OR model. | [9] |
| **Recovery**<br>Checkpointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Coordinated checkpointing algorithm – Algorithm for asynchronous checkpointing and recovery | [9] |
| **P2P& Distributed Shared Memory**<br>Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. Distributed shared memory: Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion. | [9] |
| **Total Hours** | **45** |

| **Text Book(s):** | |
|---|---|
| 1. | Kshemkalyani, Ajay D., and Mukesh Singhal. Distributed computing: principles, algorithms, and systems. Cambridge University Press, 2011. |
| 2 | George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education, 2012. |
| **Reference(s):** | |
| 1. | Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007. |
| 2. | Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994. |
| 3. | Tanenbaum A.S., Van Steen M., Distributed Systems: Principles and Paradigms, Pearson Education, 2007. |
| 4. | Liu M.L., Distributed Computing, Principles and Applications, Pearson Education, 2004. |
| 5. | Nancy A Lynch, Distributed Algorithms, Morgan Kaufman Publishers, USA, 2003. |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction** | |
| 1.1 | Definition – Relation to computer system components | 1 |
| 1.2 | Motivation – Relation to parallel systems | 1 |
| 1.3 | Message-passing systems versus shared memory systems | 1 |
| 1.4 | Primitives for distributed communication | 1 |
| 1.5 | Synchronous versus asynchronous execution - Design issues and challenges | 1 |
| 1.6 | A model of distributed computations: A distributed program | 1 |
| 1.7 | A model of distributed executions -Models of communication networks | 1 |
| 1.8 | Global state – Cuts –Past and future cones of an event | 1 |
| 1.9 | Models of process communications | 1 |
| **2** | **Message ordering & Snapshots** | |
| 2.1 | Message ordering and group communication | 1 |
| 2.2 | Message ordering paradigms | 1 |
| 2.3 | Asynchronous execution with synchronous communication | 1 |
| 2.4 | Synchronous program order on an asynchronous system | 1 |
| 2.5 | Group communication | 1 |
| 2.6 | Causal order (CO) - Total order | 1 |
| 2.7 | Global state and snapshot recording algorithms | 1 |
| 2.8 | Introduction –System model and definitions | 1 |
| 2.9 | Snapshot algorithms for FIFO channels | 1 |
| **3** | **Distributed mutex & Deadlock** | |
| 3.1 | Distributed mutual exclusion algorithms: Introduction | 1 |
| 3.2 | Preliminaries – Lamport‘s algorithm | 1 |
| 3.3 | Ricart-Agrawala algorithm | 2 |
| 3.4 | Maekawa‘s algorithm | 1 |
| 3.6 | Deadlock detection in distributed systems: Introduction | 1 |
| 3.7 | System model – Preliminaries | 1 |
| 3.8 | Models of deadlocks – Knapp‘s classification | 1 |
| 3.9 | Algorithms for the single resource model the AND model and the OR model | 1 |
| **4** | **Deep Learning for Biomedical Data Analysis** | |
| 4.1 | Check pointing and rollback recovery: Introduction | 1 |
| 4.2 | Background and definitions | 2 |
| 4.3 | Issues in failure recovery | 2 |
| 4.4 | Check point based recovery | 1 |
| 4.5 | Log based rollback recovery | 1 |
| 4.6 | Coordinated check pointing algorithm | 1 |
| 4.7 | Algorithm for asynchronous checkpointing and recovery | 1 |



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| | | |
|---|---|---|
| **5** | **P2P& Distributed shared memory** | |
| 5.1 | Peer-to-peer computing and overlay graphs: Introduction | 1 |
| 5.2 | Data indexing and overlays- Chord | 1 |
| 5.3 | Content addressable networks | 1 |
| 5.4 | Tapestry | 1 |
| 5.5 | Distributed shared memory | 2 |
| 5.6 | Abstraction and advantages | 1 |
| 5.7 | Memory consistency models | 1 |
| 5.8 | Shared memory Mutual Exclusion. | 1 |
| | **Total** | **45** |

**Course Designers**

**Dr.M.Sangeetha - sangeetham@ksrct.ac.in**



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| 60 PDS E15 | Software Engineering for Data Science | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To learn about agile and modern techniques of software development.
- To acquire the knowledge of requirements analysis, software design and UML diagrams.
- To learn the basics of system design and object design
- To acquire the knowledge of testing and rationale management
- To learn the basics of software configuration management and project management

**Prerequisite**

Basic knowledge of Software Engineering for Data Science

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Analyse and choose appropriate process model and represent the given software project scenario. | Analyse |
| **CO2** | Understand the requirements and develop suitable requirement model. | Understand |
| **CO3** | Create the software architecture model based on requirements gathered. | Create |
| **CO4** | Evaluate the different quality assurance strategies and testing methods. | Evaluate |
| **CO5** | Apply the Software Configuration Management and Model Configuration management for WebApps using different tools. | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 2 | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO3** | 2 | 3 | 2 | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 2 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 2 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom'sCategory | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 00 | 00 | 00 |
| Understand (Un) | 40 | 00 | 40 |
| Apply (Ap) | 20 | 30 | 30 |
| Analyze (An) | 00 | 20 | 20 |
| Evaluate(Ev) | 00 | 00 | 00 |
| Create (Cr) | 00 | 10 | 10 |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS E15 - Software Engineering for Data Science | | | | | | | | |
| PDS: M.Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction Software Engineering and Process Models**<br>Introduction to Software Engineering – Generic Process model – Perspective process model – Specialized process model – Unified process model – Personal and Team process model – Agile process – Extreme programming – Agile process model – Adaptive Software Development (ASD) – Scrum – Dynamic Systems Development Method (DSDM) – Crystal – Feature Driven Development (FDD) – Lean Software Development (LSD) – Agile Modelling (AM), Agile Unified Process (AUP) – Tool set for the Agile process. | [9] |
| **Software Requirements Analysis and Modeling**<br>Requirements Engineering – Eliciting requirements – Developing use cases – Building the requirement model – Negotiating requirements – validating requirements – Scenario based modelling – UML models – Data modelling – Class based, Flow oriented and Behavioural modelling – Patterns for requirement modelling – Requirement modelling for WebApps. | [9] |
| **Design Concepts and Principles**<br>Design process – Design concepts - Design model – Software architecture – Architectural genres – Architectural styles – Architectural design– Component – Designing class based components – Component level design for WebApps – Designing traditional components – Component based development - User Interface Design – Golden rules – Interface analysis and design steps – WebApp Interface design - WebApp design – Design pyramid – Aesthetic design – Content design – Architectural design – Navigation design – Component level design. | [9] |
| **Software Quality Assurance and Testing**<br>Elements of Software Quality Assurance – SQA tools, goals and metrics – Six sigma for Software Engineering – Measures of software reliability and availability – Software safety – ISO 9000 quality standards – SQA plan – Strategic approach to software testing – Verification and validation – Test strategies for conventional software – Test strategies for Object oriented software – Test strategies for WebApps – Validation testing – System Testing – Art of Debugging.<br>**Lab Exercise:** Demonstrate the working of any two standard testing tools. | [9] |
| **Software Configuration Management**<br>Software Configuration Management – Elements of SCM - SCM Repository – SCM Process – Version control - Change control – Configuration control – Status reporting - Configuration management for WebApps – Content management – Change management – Version control – Auditing and reporting.<br>**Lab Exercise:** Prepare a study report on SCM tools such as Ansible, CFEngine, Chef, Puppet, Salt. | [9] |
| **Total Hours** | 45 |

**Text book(s):**

| | |
|---|---|
| 1. | Roger S. Pressman, Software Engineering- A practitioner's Approach, 7th Edition., McGraw-Hill, 2014. |
| 2. | Ian Sommerville, Software Engineering, Pearson Education Asia, 7th Edition, 2011. |

**Reference(s):**

| | |
|---|---|
| 1. | Pankaj Jalote- An Integrated Approach to Software Engineering, Springer Verlag, 2008. |
| 2. | James F Peters and Witold Pedryez, "Software Engineering – An Engineering Approach", John Wiley and Sons, New Delhi, 2007 |
| 3. | K.K. Agarwal and Yogesh Singh, "Software Engineering", New Age International Publishers, 3rd Edition, 2008. |
| 4. | https://www.coursera.org/learn/software-processes |
| 5. | https://www.datacamp.com/courses/software-engineering-for-data-scientists-in-python |
| 6. | https://nptel.ac.in/courses/106/101/106101061/ |
| 7. | https://www.edx.org/course/software-engineering-introduction |

**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction Software Engineering and Process Models** | |
| 1.1 | Introduction to Software Engineering | 1 |



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| | | |
|---|---|---|
| 1.2 | Generic Process model ,Perspective process model | 1 |
| 1.3 | Specialized process model , Unified process model | 1 |
| 1.4 | Personal and Team process model | 1 |
| 1.5 | Agile process , Extreme programming | 1 |
| 1.6 | Agile process model , Adaptive Software Development (ASD) | 1 |
| 1.7 | Scrum , Dynamic Systems Development Method (DSDM) | 1 |
| 1.8 | Crystal , Feature Driven Development (FDD) , Lean Software Development (LSD) | 1 |
| 1.9 | Agile Modelling (AM), Agile Unified Process (AUP), Tool set for the Agile process. | 1 |
| **2** | **Software Requirements Analysis and Modeling** | |
| 2.1 | Requirements Engineering , Eliciting requirements | 1 |
| 2.2 | Developing use cases | 1 |
| 2.3 | Building the requirement model | 1 |
| 2.4 | Negotiating requirements ,validating requirements | 1 |
| 2.5 | Scenario based modelling , UML models | 1 |
| 2.6 | Data modelling | 1 |
| 2.7 | Class based, Flow oriented and Behavioral modeling | 1 |
| 2.8 | Patterns for requirement modeling | 1 |
| 2.9 | Requirement modelling for WebApps | 1 |
| **3** | **Design Concepts and Principles** | |
| 3.1 | Design process , Design concepts , Design model | 1 |
| 3.2 | Software architecture , Architectural genres | 1 |
| 3.3 | Architectural styles , Architectural design | 1 |
| 3.4 | Component , Designing class based components , Component level design for WebApps | 1 |
| 3.5 | Designing traditional components , Component based development | 1 |
| 3.6 | User Interface Design , Golden rules , Interface analysis and design steps | 1 |
| 3.7 | WebApp Interface design , WebApp design | 1 |
| 3.8 | Design pyramid , Aesthetic design , Content design | 1 |
| 3.9 | Architectural design , Navigation design , Component level design | 1 |
| **4** | **Software Quality Assurance and Testing** | |
| 4.1 | Elements of Software Quality Assurance , SQA tools, goals and metrics | 1 |
| 4.2 | Six sigma for Software Engineering , Measures of software reliability and availability | 1 |
| 4.3 | Software safety , ISO 9000 quality standards | 1 |
| 4.4 | SQA plan , Strategic approach to software testing | 1 |
| 4.5 | Verification and validation , Test strategies for conventional software | 1 |
| 4.6 | Test strategies for Object oriented software | 1 |
| 4.7 | Test strategies for WebApps | 1 |
| 4.8 | Validation testing , System Testing | 1 |



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| | | |
|---|---|---|
| 4.9 | Art of Debugging. | 1 |
| **5** | **Software Configuration Management** | |
| 5.1 | Software Configuration Management , Elements of SCM | 1 |
| 5.2 | SCM Repository , SCM Process | 1 |
| 5.3 | Version control , Change control | 1 |
| 5.4 | Configuration control | 1 |
| 5.5 | Status reporting | 1 |
| 5.6 | Configuration management for WebApps | 1 |
| 5.7 | Content management , Change management | 1 |
| 5.8 | Version control | 1 |
| 5.9 | Auditing and reporting. | 1 |
| | **Total** | **45** |

**Course Designers**

**Ms.R.Loga priya(logapriyar@ksrct.ac.in)**



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| 60 PDS E21 | Advanced Algorithms and Optimization | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To analyse the asymptotic performance of algorithms.
- To study the concepts of graph and greedy algorithm
- To synthesize efficient algorithms in common engineering design situations.
- To apply important algorithmic design paradigms
- To study methods of analysis

**Prerequisite**

**Data Structure, Design and Analysis of Algorithms**

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Analyse algorithms to determine algorithm correctness and time efficiency | Analyse |
| **CO2** | Compare a variety of advanced data structures and their implementations | Understand |
| **CO3** | Apply a variety of different algorithm design techniques | Apply |
| **CO4** | Apply and implement the learnt algorithm design techniques to solve problems | Apply |
| **CO5** | Discuss the NP completeness problems | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 2 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination(Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 10 | 10 | - |
| Understand(Un) | 20 | 20 | 20 |
| Apply(Ap) | 20 | 30 | 40 |
| Analyse(An) | 10 | - | 40 |
| Evaluate(Ev) | - | - | - |
| Create(Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS E21 - Advanced Algorithms and Optimization** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Basics of Algorithm Analysis**<br>Computational Tractability – Asymptotic Order of Growth – Implementing the Stable Matching Algorithm Using Lists and Arrays – A survey of common running times – A more Complex Data Structure: Priority Queues. | [9] |
| **Graphs and Greedy Algorithms**<br>Graphs: Basic Definitions and Applications – Graph connectivity and Graph traversal – Implementing Graph Traversal using Queues and Stacks – Testing Bipartiteness: An application of Breadth First search Greedy Algorithms: Interval Scheduling: The Greedy Algorithm Stays Ahead – Optimal Caching: A More Complex Exchange Argument – The Minimum Spanning Tree Problem – Implementing Kruskal's Algorithm: The Union-Find Data Structure – Clustering – Huffman Codes and Data Compression. | [9] |
| **Divide and Conquer**<br>The Mergesort Algorithm – Further Recurrence Relations – Counting Inversions – Finding the Closest Pair of Points – Integer Multiplication Dynamic Programming: Weighted Interval Scheduling: A Recursive Procedure – Principles of Dynamic Programming: Memoization or Iteration over Subproblems – Segmented Least Squares: Multi-way Choices – Subset Sums and Knapsacks: Adding a variable – Shortest Paths in a Graph – Shortest Paths and Distance Vector Protocols – Negative Cycles in a Graph. | [9] |
| **Network Flow**<br>The Maximum-Flow Problem and the Ford-Fulkerson Algorithm – Maximum Flows and Minimum Cuts in a Network – Choosing Good Augmenting Paths – A First Application: The Bipartite Matching Problem – Disjoint Paths in Directed and Undirected Graphs. | [9] |
| **NP and Computational Intractability**<br>Polynomial-Time Reductions – Efficient Certification and the Definition of NP – NP-Complete Problems – Sequencing Problems – Partitioning Problems – Graph Coloring – Co-NP and the Asymmetry of NP. | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | Jon Kleinberg, ÉvaTardos, 'Algorithm Design', Pearson Education Limited 2014 |
| 2. | Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 'Introduction to Algorithms', MIT Press, 2009 |
| **Reference(s):** | |
| 1. | Ellis Horowitz, SartajSahni and Sanguthevar Rajasekaran, 'Fundamentals of Computer Algorithms', Second Edition, Universities Press, Hyderabad, 2008 |
| 2. | AnanyLevitin, 'Introduction to the Design and Analysis of Algorithms', Third Edition, Pearson Education Asia, 2008. |
| 3. | Marcello La Rocca, , 'Advanced Algorithms and Data Structures', May 2021,ISBN 9781617295485 |
| 4. | Timo Masters, 'Advanced algorithms for neural networks: a C++ sourcebook', April 1995, ISBN 0471105880 |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Basics of Algorithm Analysis** | |
| 1.1 | Computational Tractability | 1 |
| 1.2 | Asymptotic Order of Growth | 1 |
| 1.3 | Implementing the Stable Matching Algorithm | 1 |
| 1.4 | Implementing the Stable Matching Algorithm Using Lists | 1 |
| 1.5 | Implementing the Stable Matching Algorithm Using Arrays | 1 |
| 1.6 | A survey of common running times | 1 |
| 1.7 | A more Complex Data Structure | 1 |
| 1.8 | Priority Queues | 1 |
| 1.9 | Priority Queues Types | 1 |
| **2** | **Graphs and Greedy Algorithms** | |
| 2.1 | Basic Definitions and Applications | 1 |
| 2.2 | Graph connectivity and Graph traversal | 1 |
| 2.3 | Implementing Graph Traversal using Queues and Stacks | 1 |
| 2.4 | Testing Bipartitions: An application of Breadth First search | 1 |
| 2.5 | Interval Scheduling - The Greedy Algorithm Stays Ahead | 1 |
| 2.6 | Optimal Caching: A More Complex Exchange Argument | 1 |
| 2.7 | The Minimum Spanning Tree Problem | 1 |
| 2.8 | Implementing Kruskal's Algorithm: The Union-Find Data Structure | 1 |
| 2.9 | Clustering – Huffman Codes and Data Compression | 1 |
| **3** | **Divide and Conquer** | |
| 3.1 | The Merge sort Algorithm | 1 |
| 3.2 | Further Recurrence Relations – Counting Inversions | 1 |
| 3.3 | Finding the Closest Pair of Points | 1 |
| 3.4 | Integer Multiplication Dynamic Programming: Weig+hted Interval Scheduling: A Recursive Procedure | 1 |
| 3.5 | Principles of Dynamic Programming: Memorization or Iteration over Sub problems | 1 |
| 3.6 | Segmented Least Squares: Multi-way Choices | 1 |
| 3.7 | Subset Sums and Knapsacks: Adding a variable | 1 |
| 3.8 | Shortest Paths in a Graph – Shortest Paths and Distance Vector Protocols | 1 |
| 3.9 | Negative Cycles in a Graph | 1 |
| **4** | **Network Flow** | |
| 4.1 | The Maximum Flow Problem | 1 |
| 4.2 | Fulkerson Algorithm | 1 |
| 4.3 | Maximum Flows in a Network | 1 |
| 4.4 | Minimum Cuts in a Network | 1 |

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| | | |
|---|---|---|
| 4.5 | Choosing Good Augmenting Paths | 1 |
| 4.6 | A First Application | 1 |
| 4.7 | The Bipartite Matching Problem | 1 |
| 4.8 | Disjoint Paths in Directed Graphs | 1 |
| 4.9 | Disjoint Paths in Undirected Graphs | 1 |
| **5** | **NP and Computational Intractability** | |
| 5.1 | Polynomial | 1 |
| 5.2 | Time Reductions | 1 |
| 5.3 | Efficient Certification | 1 |
| 5.4 | Definition of NP | 1 |
| 5.5 | NP-Complete Problems | 1 |
| 5.6 | Sequencing Problems | 1 |
| 5.7 | Partitioning Problems | 1 |
| 5.8 | Graph Colouring | 1 |
| 5.9 | Co-NP and the Asymmetry of NP. | 1 |
| | **Total** | **45** |

**Course Designers**

**Mr.K.Saravanan (saravanank@ksrct.ac.in)**



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| 60 PDS E22 | Intelligent Database Systems | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To learn NoSQL databases into web applications.
- To deploy analytical databases for OLAP and OLTP.
- To understand semi- structured data and to process XML data.
- To learn data warehouse.
- To understand some key concepts of data science.

**Prerequisite**

Database systems, SQL, XML, Data Science

**Course Outcomes**

On the successful completion of the course, studentswill beable to

| | | |
|---|---|---|
| **CO1** | Understand basic concept of database systems | Remember |
| **CO2** | Apprehend the basics of MySQL. | Understand |
| **CO3** | Apply dimensional modeling, star schemas, and ETL (extract-transform-load) for a data warehouse. | Apply |
| **CO4** | Ability of XML file format for storing, transmitting, and reconstructing arbitrary data. | Apply |
| **CO5** | Understand some key concepts of data virtualization | Understand |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 2 | 2 |
| **CO2** | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO3** | 2 | 2 | 3 | 2 | 2 | 2 |
| **CO4** | 2 | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 2 | 3 | 3 | 2 | 3 | 2 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination(Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 30 | 20 | 20 |
| Understand (Un) | 30 | 20 | 40 |
| Apply (Ap) | - | 20 | 40 |
| Analyse (An) | - | - | - |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 PDS E22 - Intelligent Database Systems | | | | | | | | |
| PDS: M.Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Overview of Intelligent Database Systems**<br>Data modeling– Conceptual models and entity-relationship diagrams– Logical models and relational schemas – Mapping ER diagrams to relational schemas – Physical data models – phpMyAdmin | [9] |
| **MySQL**<br>MySQL Workbench - Update anomalies - Functional dependencies and normalization - Entity and referential integrity constraints - Relational databases and web applications - Basic HTML and PHP - SQL injection attacks - PHP prepared statements - Object-relational mapping (ORM) - PHP Data Objects (PDO) | [9] |
| **Data warehousing**<br>Dimensional modeling and star schemas - Dimension tables and fact tables- Operational databases and online transaction processing (OLTP) - Analytical databases and online analytical processing (OLAP) - Extract-transform-load (ETL) - Content management and WordPress | [9] |
| **XML**<br>Semi-structured data and XML - Oxygen XML Editor - XPath and XQuery - FLWOR expressions - NoSQL databases and web applications – MongoDB - Documents and collections - CAP theorem vs. ACID - The Express server-side framework - Database CRUD actions and HTTP verbs - The REST API and RESTful web services | [9] |
| **Data virtualization**<br>Data virtualization - The Cisco Information Server - Query optimization - Database failure and recovery – RAID - Distributed databases - Object databases - Cloud computing - Data science - Data mining- Big Data, Hadoop, and MapReduce | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | NenadJukic, Susan Vrbsky, and SvetlozarNestorov, 'Database Systems: Introduction to Databases and Data Warehouses', Prospect Press, 2017 |
| 2. | Ralph Kimball and Margy Ross, 'The Kimball Group Reader: Relentlessly Practical Tools for Data Warehousing and Business Intelligence', Wiley, 2015 |
| **Reference(s):** | |
| 1. | Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Windom, 'Database Systems: The Complete Book, Second edition', Pearson Prentice Hall, 2009. |
| 2. | Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", SixthEdition, McGraw-Hill, 2017. |
| 3. | RamezElmasri and Shamkant B. Navathe, "Fundamental Database Systems", Sixth Edition, Pearson Education, 2010. |
| 4. | Raghu Ramakrishnan, "Database Management System", Tata McGraw-Hill Publishing, Third Edition, 2014. |



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## Course Contents and Lecture Schedule

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Overview of Intelligent Database Systems** | |
| 1.1 | Data modeling | 1 |
| 1.2 | Conceptual models | 1 |
| 1.3 | Entity-relationship diagrams | 1 |
| 1.4 | Logical models | 1 |
| 1.5 | Relational schemas | 1 |
| 1.6 | Mapping ER diagrams to relational schemas | 1 |
| 1.7 | Physical data models | 1 |
| 1.8 | PhpMyAdmin | 1 |
| **2** | **MySQL** | |
| 2.1 | MySQL Workbench | 1 |
| 2.2 | Update anomalies | 1 |
| 2.3 | Functional dependencies and normalization | 1 |
| 2.4 | Entity and referential integrity constraints | 1 |
| 2.5 | Relational databases and web applications | 1 |
| 2.6 | Basic HTML and PHP | 1 |
| 2.7 | SQL injection attacks | 1 |
| 2.8 | PHP prepared statements | 1 |
| 2.9 | Object-relational mapping (ORM) | 1 |
| 2.10 | PHP Data Objects (PDO) | 1 |
| **3** | **Data Warehousing** | |
| 3.1 | Dimensional modeling and star schemas | 1 |
| 3.2 | Dimension tables and fact tables | 1 |
| 3.3 | Operational databases and online transaction processing (OLTP) | 2 |
| 3.4 | Analytical databases and online analytical processing (OLAP) | 1 |
| 3.5 | Extract-transform-load (ETL) | 2 |
| 3.6 | Content management and WordPress | 1 |
| **4** | **XML** | |
| 4.1 | Semi-structured data and XML | 1 |
| 4.2 | Oxygen XML Editor | 1 |
| 4.3 | XPath and XQuery | 1 |
| 4.4 | FLWOR expressions | 1 |
| 4.5 | NoSQL databases and web applications | 1 |
| 4.6 | MongoDB - Documents and collections | 1 |
| 4.7 | CAP theorem vs. ACID | 1 |
| 4.8 | The Express server-side framework | 1 |
| 4.9 | Database CRUD actions and HTTP verbs | 1 |
| 4.10 | The REST API and RESTful web services | |
| **5** | **Data Virtualization** | |
| 5.1 | Data virtualization - The Cisco Information Server | 1 |
| 5.2 | Query optimization | 1 |
| 5.3 | Database failure and recovery | 1 |
| 5.4 | RAID | 1 |
| 5.5 | Distributed databases and Object databases | 1 |
| 5.6 | Cloud computing | 1 |
| 5.7 | Data science | 1 |
| 5.8 | Data mining- Big Data, Hadoop, and MapReduce | 2 |
| | **Total** | **45** |

## Course Designers

**Ms. P. Ranjetha- ranjetha@ksrct.ac.in**

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| 60 PDS E23 | Natural Language Processing and Text Mining | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To Understand Basics of Linguistics and Probability and Statistics
- To Study Concept of Syntax, Statiscal Approaches to Machine Translation
- To Learn Deep Learning for NPL
- To Study Basic of Text Mining
- To Learn Resources of Text Mining and Applications

**Prerequisite**

**Data Mining, Machine Learning**

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Understand Basics of Linguistics and Probability and Statistics. | Understand |
| **CO2** | Explain Syntax Semantics Machine Learning Techniques used. | Apply |
| **CO3** | Analysing Deep Learning for NLP | Analyse |
| **CO4** | Identity the Concepts of Text Mining | Analyse |
| **CO5** | Discuss Different Text Mining Applications | Remember |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 2 | 3 | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 2 |
| **CO4** | 3 | 2 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 3 | 3 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous AssessmentTests (Marks) | | End Sem Examination(Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 20 | 10 | 30 |
| Understand(Un) | 20 | 20 | 30 |
| Apply(Ap) | 20 | 20 | 30 |
| Analyse(An) | - | 10 | 10 |
| Evaluate(Ev) | - | - | - |
| Create(Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS E23 - Natural Language Processing and Text Mining** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Introduction to Natural Language – Fundamentals of Natural Language – Basics of Linguistics, Probability and Statistics – Words – Tokenization – Morphology – Finite State Automata – Spelling Correction – Statistical NLP. | [9] |
| **Models and Algorithms**<br>N-Grams and Language Models – Text Classification – Navie Bayes – Vector Space Models – Sequence Labiling – Part of Speech Tags – Hidden Markov Models – Syntax Analysis – CYK Algorithm – Earley's Algorithm – Tree Banks. | [9] |
| **Dependency Parsing**<br>Word Sense Disambiguation, Word Net, Dependency Parsing Semantic Role Labeling and Semantic Parsing – Statistical Machine Transalation – Deep Learning for Nlp – Word Embedding – Information Extraction, Sentiment Analysis | [9] |
| **Text Mining**<br>Introduction to Text Mining – Text Mining Pipeline – Approaches to Text Mining – Data Mining and Visualization – Evaluation of Text Mining Systems. | [9] |
| **Systems and Application**<br>Resources for Text Minig – Distributed Text Mining – Scalable Text Mining Systems – Text Mining Applications and Services – Case Studies. | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | Daniel Jurafsky and James H.Martin, 'Speech and lLanguage Processing and Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition', 2nd Edition, Pearson Education India. 2013. |
| 2. | Feldman and Ronen 'The Text Mining Handbook: Advanced Approaches in analyzing unstructured data' Cambridge University Press, 2007. |
| **Reference(s):** | |
| 1. | Nitin Indurkhya, Fred J.Damerau, 'Handbook of Natural Language Processing', 2nd Edition, 2010 |
| 2. | YoavGoldberg, Graeme Hirst, 'Neural Network Methods for Natural Languages Processing' Morgan and Claypool Life Sciences, 2017 |
| 3. | Deepti Chopra, Nishrrth Joshi, 'Mastering Natural Language Processing with Python', Packt Publishing Limited,2016 |
| 4. | 'Text Mining for Biology and Biomedicine', Artech House, 2006 |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction** | |
| 1.1 | Introduction to Natural Language | 1 |
| 1.2 | Fundamentals of Natural Language | 1 |
| 1.3 | Basics of Linguistics | 1 |
| 1.4 | Probability and Statistics | 1 |
| 1.5 | Words | 1 |
| 1.6 | Tokenization – Morphology | 1 |
| 1.7 | Finite State Automata | 1 |
| 1.8 | Spelling Correction | 1 |
| 1.9 | Statistical NLP. | 1 |
| **2** | **Models and Algorithms** | |
| 2.1 | N-Grams and Language Models | 1 |
| 2.2 | Text Classification – Naive Bayes | 1 |
| 2.3 | Vector Space Models | 1 |
| 2.4 | Sequence Labeling – Part of Speech Tags | 1 |
| 2.5 | Hidden Markov Models | 1 |
| 2.6 | Syntax Analysis | 1 |
| 2.7 | CYK Algorithm | 1 |
| 2.8 | Earley's Algorithm | 1 |
| 2.9 | Tree Banks | 1 |
| **3** | **Dependency Parsing** | |
| 3.1 | Word Sense Disambiguation | 1 |
| 3.2 | Word Net | 1 |
| 3.3 | Dependency Parsing Semantic Role Labeling | 1 |
| 3.4 | Semantic Parsing | 1 |
| 3.5 | Statistical Machine Translation | 1 |
| 3.6 | Deep Learning for Nlp | 1 |
| 3.7 | Word Embedding | 1 |
| 3.8 | Information Extraction | 1 |
| 3.9 | Sentiment Analysis | 1 |
| **4** | **Text Mining** | |
| 4.1 | Introduction | 1 |
| 4.2 | Text Mining | 1 |
| 4.3 | Text Mining Pipeline | 1 |
| 4.4 | Approaches to Text Mining | 1 |
| 4.5 | Data Mining | 1 |
| 4.6 | Data Mining techniques | 1 |

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| | | |
|---|---|---|
| 4.7 | Visualization | 1 |
| 4.8 | Visualization techniques | 1 |
| 4.9 | Evaluation of Text Mining Systems | 1 |
| **5** | **Systems and Application** | |
| 5.1 | Introduction | 1 |
| 5.2 | Resources for Text Mining | 1 |
| 5.3 | Distributed Text Mining | 1 |
| 5.4 | Distributed Text Mining Types | 1 |
| 5.5 | Scalable Text Mining Systems | 1 |
| 5.6 | Text Mining Applications | 1 |
| 5.7 | Text Mining Services | 1 |
| 5.8 | Text Mining Methods | 1 |
| 5.9 | Case Studies. | 1 |
| | Total | 45 |

**Course Designers**

**Mr.K.Saravanan (saravanank@ksrct.ac.in)**



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| 60 PDS E24 | Time Series Analysis and Forecasting | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To describe the fundamental advantage and necessity of forecasting in various situations.
- To show a changing variable that regresses on its own lagged, or prior, values.
- To represent the differencing of raw observations to allow for the time series to become stationary
- To incorporate the dependency between an observation and a residual error from a moving average model applied to lagged observations.
- To understand Time Series sequence of numerical data points in successive order

**Prerequisite**

Basic knowledge of Higher Secondary Mathematics, Python.

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Understand the fundamentals and necessities of forecasting in various situations. | Understand |
| **CO2** | Identify how to choose an appropriate forecasting method in a particular environment. | Remember |
| **CO3** | Apply various forecasting methods, which include obtaining the relevant data and carrying out the necessary computation using suitable statistical software | Apply |
| **CO4** | Improve forecast with better statistical models based on statistical analysis | Apply |
| **CO5** | Analyse several different types of time series data for forecasting purposes. | Analyse |

Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | 2 | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 2 | 3 | 2 |
| **CO3** | 3 | 1 | 2 | 2 | 2 | 2 |
| **CO4** | 2 | 2 | 2 | 2 | 3 | 3 |
| **CO5** | 2 | 1 | 2 | 2 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 30 | - | 20 |
| Understand (Un) | 30 | 30 | 20 |
| Apply (Ap) | - | 30 | 30 |
| Analyse (An) | - | - | 30 |
| Evaluate(Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS E24 - Time Series Analysis and Forecasting | | | | | | | | |
| PDS: M.Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction and Regression Analysis**<br>An Introduction to Forecasting: Forecasting Data and its methods-Errors in Forecasting-Forecasting Technique.-An Overview of Quantitative Forecasting Techniques.<br>Regression Analysis: Simple Linear Regression Model-Least Squares Point Estimates-Point Estimates and Predictions- Model Assumptions and the Standard Error-Testing the Significance of the Slope and y Intercept- Confidence and Prediction Intervals- Simple Coefficients of Determination and Correlation | [9] |
| **Model Building and Residual Analysis of Linear Regressions**<br>Multiple Linear Regressions: Linear Regression Model - Mean Square Error and the Standard Error-Model Utility: R2, Adjusted R2, and the Overall F Test.<br>Model Building and Residual Analysis: Model Building and the Effects of Multicollinearity - Residual Analysis in Simple Regression and Multiple Regression-Diagnostics for Detecting Outlying and Influential Observations | [9] |
| **Time Series Analysis and Exponential Smoothing**<br>Time Series Regression: Modelling Trend by Using Polynomial Functions-Detecting Autocorrelation-Types of Seasonal Variation - Modelling Seasonal Variation by Using Dummy Variables and Trigonometric Functions - Growth Curves - Handling First-Order Autocorrelation.<br>Decomposition Methods: Multiplicative and Additive Decomposition- X-12-ARIMA Seasonal Adjustment Method - Exercises.<br>Exponential Smoothing: Simple Exponential Smoothing-Tracking Signals - Holt's Trend Corrected Exponential Smoothing -Holt-Winters Methods - Damped Trends and Other Exponential | [9] |
| **Non-Seasonal Box-Jenkins Modelling**<br>Non-seasonal Box-Jenkins Modelling and Their Tentative Identification: Stationary and Nonstationary Time Series - Sample and Partial Autocorrelation Functions: The SAC and SPAC - Introduction to Non-seasonal Modelling and Forecasting -Tentative Identification of Non-seasonal Box-Jenkins Models.<br>Estimation, Diagnostic Checking, and Forecasting for Non-seasonal Box-Jenkins Models: Estimation - Diagnostic Checking – Forecasting- Case Study - Box-Jenkins Implementation of Exponential Smoothing. | [9] |
| **Seasonal Box-Jenkins Modelling**<br>Box-Jenkins Seasonal Modelling: Transforming a Seasonal Time Series into a Stationary Time Series-Examples- Box-Jenkins Error Term Models in Time Series Regression.<br>Advanced Box-Jenkins Modelling: General Seasonal Model and Guidelines for Tentative Identification - Intervention Models - Procedure for Building a Transfer Function Model<br>Causality in time series: Granger causality- Hypothesis testing on rational expectations - Hypothesis testing on market efficiency. | [9] |
| **Total Hours** | **45** |

| | |
|---|---|
| **Text book(s):** | |
| 1. | Bruce L. Bowerman, Richard O'Connell, Anne Koehler, "Forecasting, Time Series, and Regression, 4th Edition", Cengage Unlimited Publishers, 2021 |
| 2. | P. J. Brockwell, R. A. Davis, "Introduction to Time Series and Forecasting" Springer, 2016 |
| **Reference(s):** | |
| 1. | Cryer, Jonathan D.; Chan, Kung-sik, "Time series analysis : with applications in R", ed.: New York: Springer, cop. 2008 |
| 2. | Mills, T.C. The Econometric Modelling of Financial Time Series. Cambridge University Press, 1999 |
| 3. | Andrew C. Harvey. Time Series Models. Harvester wheatsheaf, 1993 |
| 4. | Enders W. Applied Econometric Time Series. John Wiley & Sons, Inc., 1995 |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction and Regression Analysis** | |
| 1.1 | An Introduction to Forecasting- Forecasting Data and its methods - Errors in Forecasting | 1 |
| 1.2 | Forecasting Technique - An Overview of Quantitative Forecasting Techniques | 1 |
| 1.3 | An Introduction to Regression Analysis - Simple Linear Regression Model | 1 |
| 1.4 | Least Squares Point Estimates | 1 |
| 1.5 | Point Estimates and Predictions | 1 |
| 1.6 | Model Assumptions and the Standard Error | 1 |
| 1.7 | Testing the Significance of the Slope and y Intercept | 1 |
| 1.8 | Confidence and Prediction Intervals | 1 |
| 1.9 | Simple Coefficients of Determination and Correlation | 1 |
| **2** | **Model Building and Residual Analysis of Linear Regressions** | |
| 2.1 | Linear Regression Model | 1 |
| 2.2 | Mean Square Error and the Standard Error | 1 |
| 2.3 | Model Utility: R2, Adjusted R2 | 1 |
| 2.4 | the Overall F Test | 1 |
| 2.5 | Introduction to Model Building and Residual Analysis | 1 |
| 2.6 | Building and the Effects of Multicollinearity | 1 |
| 2.7 | Model | 1 |
| 2.8 | Residual Analysis in Simple Regression and Multiple Regression | 1 |
| 2.9 | Diagnostics for Detecting Outlying and Influential Observations | 1 |
| **3** | **Time Series Analysis and Exponential Smoothing** | |
| 3.1 | Time Series Regression: Modelling Trend by Using Polynomial Functions | 1 |
| 3.2 | Detecting Autocorrelation - Types of Seasonal Variation | 1 |
| 3.3 | Modelling Seasonal Variation by Using Dummy Variables and Trigonometric Functions | 1 |
| 3.4 | Growth Curves - Handling First-Order Autocorrelation | 1 |
| 3.5 | Multiplicative and Additive Decomposition | 1 |
| 3.6 | X-12-ARIMA Seasonal Adjustment Method - Exercises. | 1 |
| 3.7 | Simple Exponential Smoothing- Tracking Signals | 1 |
| 3.8 | Holt's Trend Corrected Exponential Smoothing -Holt-Winters Methods | 1 |
| 3.9 | Damped Trends and Other Exponential | 1 |
| **4** | **Non-Seasonal Box-Jenkins Modelling** | |
| 4.1 | Introduction to Non-seasonal Box-Jenkins Modelling and Their Tentative Identification | 1 |
| 4.2 | Stationary and Nonstationary Time Series | 1 |
| 4.3 | Sample and Partial Autocorrelation Functions: The SAC and SPAC | 1 |
| 4.4 | Introduction to Non-seasonal Modelling and Forecasting | 1 |
| 4.5 | Tentative Identification of Non-seasonal Box-Jenkins Models | 1 |

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| | | |
|---|---|---|
| 4.6 | Estimation | 1 |
| 4.7 | Diagnostic Checking | 1 |
| 4.8 | Forecasting - Case Study | 1 |
| 4.9 | Box-Jenkins Implementation of Exponential Smoothing. | 1 |
| **5** | **Seasonal Box-Jenkins Modelling** | |
| 5.1 | Box-Jenkins Seasonal Modelling | 1 |
| 5.2 | Transforming a Seasonal Time Series into a Stationary Time Series | 1 |
| 5.3 | Examples | 1 |
| 5.4 | Box-Jenkins Error Term Models in Time Series Regression. | 1 |
| 5.5 | General Seasonal Model and Guidelines for Tentative Identification | 1 |
| 5.6 | Intervention Models | 1 |
| 5.7 | Procedure for Building a Transfer Function Model | 1 |
| 5.8 | Granger causality- Hypothesis testing on rational expectations | 1 |
| 5.9 | Hypothesis testing on market efficiency | 1 |
| | **Total** | **45** |

**Course Designers**

**Ms.M.Vaishnavi - vaishanavi@ksrct.ac.in**



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| 60 PDS E25 | Predictive Modeling and Data Analytics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To identify techniques and models associated with Predictive Modeling
- To study the concepts of data mining and preprocessing data techniques
- To apply the clustering model and analysis and its predictive data
- To design an hierarchical clustering using ANOVA
- To implement the application of Predictive Modeling and Data Analytics

**Prerequisite**

Data Mining, Machine Learning

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Apply the various techniques in predictive modeling | Apply |
| **CO2** | Analyze the complexity of data and various methods in data | Analyse |
| **CO3** | Apply the various models in predictive of the data | Apply |
| **CO4** | Illustrate the methods of clustering in data analytics | Apply |
| **CO5** | Analyze the regression trees in data analytics | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO3** | 2 | 2 | 3 | 3 | 3 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 |
| **3-Strong; 2-Medium; 1-Some** | | | | | | |

**Asessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | - | - | - |
| Understand (Kn) | 30 | 30 | 20 |
| Apply (Ap) | 20 | 30 | 40 |
| Analyse (An) | 10 | - | 40 |
| Evaluate(Ev) | - | - | - |
| Create (Cr) | - | - | - |



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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 PDS E25 - Predictive Modeling and Data Analytics | | | | | | | | |
| PDS: M.Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Introduction to predictive analytics – Business analytics: types, applications-predictive models – descriptive models – decision models - applications - analytical techniques | [9] |
| **Understanding Data**<br>Data types and associated techniques – complexities of data – data preparation, pre-processing – exploratory data analysis- supervised versus unsupervised methods, statistical and data mining methodology- cross-validation overfitting- bias-variance trade-off- balancing the training dataset | [9] |
| **Principles and Techniques**<br>Predictive modeling: Propensity models, cluster models, collaborative filtering, applications and limitations - Statistical analysis: Univariate Statistical analysis, Multivariate Statistical analysis-Case Study on Predictive model | [9] |
| **Data Analytics**<br>Introduction to data analytics –Python Fundamentals-introduction to probability-sample distribution-Hypothesis testing- Two sample testing and introduction to ANOVA-Two way ANOVA and linear regression-multiple regression-k-means clustering- Hierarchical methods of clustering -Concepts of MLE and Logistic regression-Case Study on ANOVA | [9] |
| **Regression Analysis**<br>ROC and Regression Analysis model building-c2 Test and introduction to cluster analysis-Clustering analysis-Classification and Regression Trees-Measure of attribute selection- Case Study on real time problems in Clustering | [9] |
| **Total Hours** | **45** |

**Text book(s)**

| | |
|---|---|
| 1. | Jeffrey Strickland, Predictive analytics using R, Simulation educators, Colorado Springs, 2015 |
| 2. | Max Kuhn and Kjell Johnson, Applied Predictive Modeling, First edition Springer, 2013. |

**Reference(s):**

| | |
|---|---|
| 1. | Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive analytics for dummies, 2nd Edition Wiley, 2016. |
| 2. | Dinov, ID., Data Science and Predictive Analytics: Biomedical and Health Applications using R, Springer, 2018. |
| 3. | Daniel T.Larose and Chantal D.Larose, Data Mining and Predictive analytics, 2nd edition Wiley, 2015. |
| 4. | Eric Siegel, Predictive Analytics Second edition Wiley, 2016. |



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Course Contents and Lecture Schedule

| S.No. | Topic | No.of Hours |
|---|---|---|
| 1 | **Introduction** | |
| 1.1 | Introduction to predictive analytics | 1 |
| 1.2 | Business analytics | 1 |
| 1.3 | Types | 1 |
| 1.4 | Applications | 1 |
| 1.5 | predictive models | 1 |
| 1.6 | descriptive models | 1 |
| 1.7 | decision models | 1 |
| 1.8 | Applications | 1 |
| 1.9 | analytical techniques | 1 |
| 2 | **Understanding Data** | |
| 2.1 | Data types and associated techniques | 1 |
| 2.2 | complexities of data | 1 |
| 2.3 | Data preparation | 1 |
| 2.4 | Preprocessing | 1 |
| 2.5 | exploratory data analysis- supervised versus unsupervised methods | 1 |
| 2.6 | statistical and data mining methodology | 1 |
| 2.7 | cross-validation over fitting | 1 |
| 2.8 | bias-variance trade-off | 1 |
| 2.9 | balancing the training dataset | 1 |
| 3 | **Principles and Techniques** | |
| 3.1 | Predictive modeling | 1 |
| 3.2 | Propensity models | 1 |
| 3.3 | Cluster model | 1 |
| 3.4 | collaborative filtering | 1 |
| 3.5 | applications | 1 |
| 3.6 | Limitations | 1 |
| 3.7 | Statistical analysis | 1 |
| 3.8 | Univariate Statistical analysis | 1 |
| 3.9 | Multivariate Statistical analysis | 1 |
| 4 | **Data Analytics** | |
| 4.1 | Introduction to data analytics | 1 |
| 4.2 | Python Fundamentals | 1 |
| 4.3 | Introduction to probability | 1 |
| 4.4 | Sample distribution | 1 |
| 4.5 | Hypothesis testing | 1 |
| 4.6 | Two sample testing and introduction to ANOVA | 1 |

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| | | |
|---|---|---|
| 4.7 | Two way ANOVA and linear regression | 1 |
| 4.8 | multiple regression-k-means clustering | 1 |
| 4.9 | Hierarchical methods of clustering -Concepts of MLE and Logistic regression | 1 |
| 5 | **Regression Analysis** | |
| 5.1 | ROC | 1 |
| 5.2 | Regression Analysis model building | 1 |
| 5.3 | c2 Test | 1 |
| 5.4 | Introduction to cluster analysis | 1 |
| 5.5 | Clustering analysis | 1 |
| 5.6 | Classification | 1 |
| 5.7 | Regression Trees | 1 |
| 5.8 | Measure of attribute selection | 1 |
| 5.9 | Problems on clustering | 1 |
| | Total | 45 |

**Course Designers**

**Mr.M.Thilakraj(mthilakraj@ksrct.ac.in)**



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| 60 PDS E31 | Reinforcement Learning | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To understand the basic mathematical foundations of reinforcement learning
- To impart knowledge on the temporal difference and eligibility traces
- To explore a dynamic programming and Monte-Carlo methods
- To analyze the policy gradient methods
- To develop hierarchical RL frameworks

**Prerequisite**

**Data Mining, Machine Learning**

**Course Outcomes**

**At the end of the course, the students will be able to**

| | | |
|---|---|---|
| **CO1** | Identify the reward function and Markov Decision Process | Understand |
| **CO2** | Apply temporal difference (TD) learning method for reinforcement learning problem | Apply |
| **CO3** | Analyse to Solve problems using Dynamic Programming | Analyse |
| **CO4** | Recognize to Gradient methods for Reinforcement Learning | Understand |
| **CO5** | Apply Hierarchical Reinforcement Learning Algorithms | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 2 |
| **CO4** | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 2 | 2 | 3 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 20 | 10 | 10 |
| Understand(Un) | 20 | 20 | 30 |
| Apply (Ap) | 20 | 20 | 30 |
| Analyse (An) | - | 10 | 30 |
| Evaluate(Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS E31 - Reinforcement Learning** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| **II** | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Reinforcement Learning Problem**<br>Evaluative feedback-nonassociative learning-Rewards and returns-Markov Decision Processes-Value functions-optimality and approximation .Bandit Problems: Explore-exploit dilemma- Binary Bandits-Learning automata-exploration schemes<br>**Case study**:Elevator dispatching | [9] |
| **Temporal Difference Learning**<br>TD prediction,-Optimality of TD(0)- SARSA- Q-learning-R-learning-Games and after states.<br>Eligibility Traces :n-step TD prediction-TD(lambda)-forward and backward views-Q(lambda)-SARSA(lambda)-replacing traces and accumulating traces.<br>**Case study:**TDgammon | [9] |
| **Dynamic Programming**<br>Value iteration,-policy iteration- asynchronous DP-generalized policy iteration.Monte-Carlomethods: Policy evaluation-roll outs -on policy and off policy learning-importance sampling –<br>**Case study**:Helicopter piloting | [9] |
| **Function Approximation**<br>Value prediction-gradient descent methods- linear function approximation- Control algorithms- Fitted Iterative Methods .Policy Gradient Methods:non-associative learning - REINFORCE algorithm-exact gradient methods-estimating gradients-approximate policy gradient algorithms-actorcritic methods<br>**Case study:**Computational Neuroscience | [9] |
| **Hierarchical RI Anddeep Reinforcement Learning**<br>MAXQ framework-Options framework-HAM framework-Option discovery algorithms.Deep Q-Networks-Double Deep-Q Networks(DQN, DDQN, Dueling DQN, PrioritizedExperience Replay).- **Case study**:on real world problems in Deep Reinforcement learning | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | Richard S. Sutton and Andrew G. Barto, 'Reinforcement learning: An Introduction', 2nd Edition, MIT Press, 2019. |
| 2. | Russell, Stuart J., and Peter Norvig. 'Artificial intelligence: a modern approach', Pearson Education Limited, 2016. |

**Reference(s):**

| | |
|---|---|
| 1. | Ian Goodfellow, YoshuaBengio, and Aaron Courville. 'Deep learning'. MIT press, 2017. |
| 2. | Keng, Wah Loon, Graesser, Laura, 'Foundations of Deep Reinforcement Learning: Theory and Practice in Python', Addison Wesley Data & Analytics Series, 2020. |
| 3. | Francois Chollet, 'Deep Learning with Python', Manning Publications, 2018. |
| 4. | Michael Wooldridge, 'An Introduction to Multi Agent Systems', John Wiley, 2002. |



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**Course Contents and Lecture Schedule**

| S.No | Topic | No. of Hours |
|---|---|---|
| 1 | **Reinforcement Learning Problem** | 1 |
| 1.1 | Evaluative Feedback, Non-Associative Learning | 1 |
| 1.2 | Rewards and Returns | 1 |
| 1.3 | Markov Decision Processes | 1 |
| 1.4 | Value Functions | 1 |
| 1.5 | Optimality and Approximation | 1 |
| 1.6 | Bandit Problems: Explore- Exploit Dilemma | 1 |
| 1.7 | Binary Bandits | 1 |
| 1.8 | Learning Automata | 1 |
| 1.9 | Exploration Schemes | 1 |
| 2 | **Temporal Difference Learning** | |
| 2.1 | TD Prediction | 1 |
| 2.2 | Optimality Of TD (0)- SARSA | 1 |
| 2.3 | Q-Learning,R-Learning | 1 |
| 2.4 | Games and After States | 1 |
| 2.5 | Eligibility Traces: N-Step TD Prediction | 1 |
| 2.6 | TD (Lambda) | 1 |
| 2.7 | Forward And Backward Views | 1 |
| 2.8 | Q(Lambda),SARSA (Lambda) | 1 |
| 2.9 | Replacing Traces And Accumulating Traces. | 1 |
| 3 | **Dynamic Programming** | |
| 3.1 | Value Iteration | 1 |
| 3.2 | Policy Iteration | 1 |
| 3.3 | Asynchronous DP | 1 |
| 3.4 | Generalized Policy Iteration | 1 |
| 3.5 | Monte-Carlo Methods | 1 |
| 3.6 | Policy Evaluation | 1 |
| 3.7 | Roll Outs | 1 |
| 3.8 | On Policy and Off Policy Learning | 1 |
| 3.9 | Importance Sampling | 1 |
| 4 | **Function Approximation** | |
| 4.1 | Value Prediction | 1 |
| 4.2 | Gradient Descent Methods | 1 |
| 4.3 | Linear Function Approximation | 1 |
| 4.4 | Control Algorithms | 1 |
| 4.5 | Fitted Iterative Methods | 1 |



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| | | |
|---|---|---|
| 4.6 | Policy Gradient Methods: Non-Associative Learning | 1 |
| 4.7 | REINFORCE Algorithm | 1 |
| 4.8 | Exact Gradient Methods, Estimating Gradients | 1 |
| 4.9 | Approximate Policy Gradient Algorithms-Actor Critic Methods | 1 |
| 5 | **Hierarchical Rl and Deep Reinforcement Learning** | |
| 5.1 | MAXQ framework | 1 |
| 5.2 | Options framework | 1 |
| 5.3 | HAM framework | 1 |
| 5.4 | Option discovery algorithms | 1 |
| 5.5 | Deep Q-Networks | 1 |
| 5.6 | Double Deep | 2 |
| 5.7 | Q Networks (DQN, DDQN, Dueling DQN, Prioritized Experience Replay) | 2 |
| | Total | 45 |

**Course Designers**

**S.Raja(rajas@ksrct.ac.in)**



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| 60 PDS E32 | Recommender Systems | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- Understand the basic concepts of recommender systems.
- To learn techniques for including non-personalized, content-based, and collaborative filtering
- To automate a variety of choice-making strategies with the goal of providing affordable, personal and high quality recommendations.
- To learn performance evaluation of recommender systems based on various metrics.
- Implement machine-learning and data-mining algorithm in recommender systems data sets.

**Prerequisite**

Basic knowledge of Higher Secondary Mathematics, Binary Operations & Mathematical Logic.

**Course Outcomes**

On the successful completion ofthecourse,studentswill beable to

| | | |
|---|---|---|
| **CO1** | Classify the filtering techniques and issues in the recommender system | Understand |
| **CO2** | Cite the content –based filtering and collaborative filtering | Understand |
| **CO3** | Define recommendation system for a particular application domain. | Remember |
| **CO4** | Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity | Apply |
| **CO5** | Demonstrate Applications of recommendation systems | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 2 | 2 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 30 | 10 | 30 |
| Understand (Un) | 30 | 20 | 30 |
| Apply (Ap) | - | 30 | 40 |
| Analyse (An) | - | - | - |
| Evaluate(Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS E32 - Recommender Systems | | | | | | | | |
| PDS: M.Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction**<br>Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system. | [9] |
| **Content-Based Filtering**<br>High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms. | [9] |
| **Collaborative Filtering**<br>User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems. | [9] |
| **Hybrid Approaches**<br>Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies. | [9] |
| **Applications of RSs**<br>RSs for content media, social media and communities Music and video RSs. Datasets. Group recommender systems. Social recommendations. Recommending friends: link prediction models. Similarities and differences of RSs with task assignment in mobile crowd sensing, social network diffusion awareness in RSs. | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | Jannach D., Zanker M. and FelFering A., 'Recommender Systems: An Introduction, Cambridge University Press(2011)', 1st Edition. 6. |
| 2. | Manouselis N., Drachsler H., Verbert K., Duval E., 'Recommender Systems For Learning, Springer (2013),' 1st Edition. |

**Reference(s):**

| | |
|---|---|
| 1. | J. Leskovec, A. Rajaraman and J. Ullman, 'Mining of massive datasets', 2nd Edition, Cambridge, 2012. |
| 2. | Charu C. Aggarwal, 'Recommender Systems: The Textbook, Springer (2016),' 1st Edition. |
| 3. | Ricci F., Rokach L., Shapira D., Kantor B.P., 'Recommender Systems Handbook,' Springer(2011), 1st Edition. |
| 4. | Hill, Will, Larry Stead, Mark Rosenstein, and George Furnas. 1995. 'Recommending and Evaluating Choices in a Virtual Community of Use. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, 194–201. CHI '95. New York, NY, USA: ACM Press/Addison-Wesley Publishing Co. doi:10.1145/223904.223929. |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction** | |
| 1.1 | Overview of Information Retrieval, | 1 |
| 1.2 | Retrieval Models, Search and Filtering Techniques | 1 |
| 1.3 | Relevance Feedback, User Profiles, | 1 |
| 1.4 | Recommender system functions | 1 |
| 1.5 | Matrix operations, covariance matrices | 1 |
| 1.6 | Understanding ratings | 1 |
| 1.7 | Applications of recommendation systems | 2 |
| 1.8 | Issues with recommender system. | 1 |
| **2** | **Content-Based Filtering** | |
| 2.1 | High level architecture of content-based systems, | 1 |
| 2.2 | Advantages and drawbacks of content based filtering, Item profiles | 1 |
| 2.3 | Discovering features of documents | 1 |
| 2.4 | pre-processing and feature extraction | 1 |
| 2.5 | Obtaining item features from tags, | 1 |
| 2.6 | Methods for learning user profiles | 1 |
| 2.7 | Similarity based retrieval | 1 |
| 2.8 | Classification algorithms. | 2 |
| **3** | **Collaborative Filtering** | |
| 3.1 | User-based recommendation | 1 |
| 3.2 | Item-based recommendation | 2 |
| 3.3 | Model based approaches | 2 |
| 3.4 | Matrix factorization | 2 |
| 3.5 | Attacks on collaborative recommender systems | 2 |
| **4** | **Hybrid Approaches** | |
| 4.1 | Opportunities for hybridization | 1 |
| 4.2 | Monolithic hybridization design | 1 |
| 4.3 | Feature combination | 1 |
| 4.4 | Feature augmentation | 1 |
| 4.5 | Parallelized hybridization design: Weighted | 1 |
| 4.6 | Switching, Mixed, Pipelined hybridization design | 1 |
| 4.7 | Cascade Meta-level | 2 |
| 4.8 | Limitations of hybridization strategies | 1 |
| **5** | **Applications of RSs** | |
| 5.1 | RSs for content media, social media | 1 |
| 5.2 | Communities Music and video RSs | 2 |
| 5.3 | Datasets. Group recommender systems | 1 |
| 5.4 | Social recommendations | 1 |
| 5.5 | Recommending friends: link prediction models | 1 |
| 5.6 | Similarities and differences of RSs with task assignment in mobile crowd sensing | 1 |
| 5.7 | social network diffusion awareness in RSs. | 2 |
| | **Total** | **45** |

**Course Designers**

**Mr.SenthilKumar K - senthilkumark@ksrct.ac.in**

| 60 PDS E33 | Big Data Security | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

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## Objective(s)

- To understand the mathematical foundations of security principles
- To appreciate the different aspects of encryption techniques
- To understand the role played by authentication in security
- To learn the various techniques in security analytics
- To understand the security concerns of big-data.

## Prerequisite

Basic knowledge of Cryptography and Network security, Big data & Mathematical Logic.

## Course Outcomes

On the successful completion of the course,students will be able to

| | | |
|---|---|---|
| **CO1** | Design algorithms in a secure manner for Big data applications | Understand |
| **CO2** | Analyse the knowledge about the confidentiality factors and encryption techniques. | Analyse |
| **CO3** | Know the authentication and confidentiality hash function and to expel the third party penetration in a mail transfer between two parties. | Apply |
| **CO4** | Use available security practices in big-data Security analytics | Apply |
| **CO5** | Recognize the Security Analysis with Text Mining | Apply |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO3** | 3 | 3 | 2 | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 | 3 |

**3-Strong; 2-Medium; 1-Some**

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 20 | 20 | 20 |
| Understand (Un) | 10 | 10 | 40 |
| Apply (Ap) | 20 | 30 | 30 |
| Analyse (An) | 10 | - | 10 |
| Evaluate(Ev) | - | - | - |
| Create(Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS E33 - Big Data Security** | | | | | | | | |
| **PDS: M.Tech Data Science** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Symmetric Techniques**<br>Probability and Information Theory - Algebraic foundations – Number theory - Substitution Ciphers – Transposition Ciphers – Classical Ciphers – DES – AES – Confidentiality Modes of Operation | [9] |
| **Asymmetric Techniques**<br>Diffie-Hellman Key Exchange protocol – Discrete logarithm problem – RSA cryptosystems & cryptanalysis – ElGamal cryptosystem – Elliptic curve architecture and cryptography - Data Integrity techniques**.** | [9] |
| **Authentication**<br>Authentication requirements – Authentication functions – Message authentication codes – Hash functions – Security of hash functions and MACS – MD5 Message Digest algorithm – Secure hash algorithm. | [9] |
| **Security Analytics I**<br>Introduction to Security Analytics – Techniques in Analytics – Analysis in everyday life – Challenges in Intrusion and Incident Identification – Analysis of Log file – Simulation and Security Process. | [9] |
| **Security Analytics II**<br>Access Analytics – Security Analysis with Text Mining – Security Intelligence – Security Breaches | [9] |
| **Total Hours** | **45** |

**Text book(s):**

| | |
|---|---|
| 1. | William Stallings, 'Cryptography And Network Security – Principles and Practices', 8th Edition, Prentice Hall of India, 2020 |
| 2. | Behrouz A. Forouzen, Dabdeep Mukhopadhya, 'Cryptography and Network Security', Tata McGraw-Hill, 2012. |

**Reference(s):**

| | |
|---|---|
| 1. | Douglas R. Stinson, 'Cryptography Theory and Practice ', Chapman & Hall/CRC, Third Edition, 2006. |
| 2. | Mark Talabis, Robert McPherson, I Miyamoto and Jason Martin, 'Information Security Analytics: Finding Security Insights, Patterns, and Anomalies in Big Data',Syngress Media, U.S., 2014 |
| 3. | Padmanabhan T R, Shyamala C and Harini N, 'Cryptography and Security', Wiley Publications 2011. |
| 4. | Josef Pieprzyk, Thomas Hardjono and Jenifer Seberry, 'Fundamentals of Computer Security', Springer 2010. |



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## Course Contents and Lecture Schedule

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Symmetric Techniques** | |
| 1.1 | Probability and Information Theory | 1 |
| 1.2 | Algebraic foundations | 1 |
| 1.3 | Number theory | 1 |
| 1.4 | Substitution Ciphers | 1 |
| 1.5 | Transposition Ciphers | 1 |
| 1.6 | Classical Ciphers | 1 |
| 1.7 | DES | 1 |
| 1.8 | AES | 1 |
| 1.9 | Confidentiality Modes of Operation | 1 |
| **2** | **Asymmetric Techniques** | |
| 2.1 | Diffie-Hellman Key Exchange protocol | 2 |
| 2.2 | Discrete logarithm problem | 1 |
| 2.3 | RSA cryptosystems & cryptanalysis | 2 |
| 2.4 | ElGamal cryptosystem | 1 |
| 2.5 | Elliptic curve architecture and cryptography | 2 |
| 2.6 | Data Integrity techniques. | 1 |
| **3** | **Authentication** | |
| 3.1 | Authentication requirements | 1 |
| 3.2 | Authentication functions | 1 |
| 3.3 | Message authentication codes | 2 |
| 3.4 | Hash functions | 1 |
| 3.5 | Security of hash functions and MACS | 2 |
| 3.6 | MD5 Message Digest algorithm | 1 |
| 3.7 | Secure hash algorithm. | 1 |
| **4** | **Security Analytics I** | |
| 4.1 | Introduction to Security Analytics | 1 |
| 4.2 | Techniques in Analytics | 2 |
| 4.3 | Analysis in everyday life | 2 |
| 4.4 | Challenges in Intrusion and Incident Identification | 2 |
| 4.5 | Analysis of Log file | 1 |
| 4.6 | Simulation and Security Process | 1 |
| **5** | **Security Analytics II** | |
| 5.1 | Access Analytics | 2 |
| 5.2 | Security Analysis with Text Mining | 3 |
| 5.3 | Security Intelligence | 2 |
| 5.4 | Security Breaches | 2 |
| | **Total** | **45** |

Course Contents and Lecture Schedule

**Dr.C.Rajan- rajan@ksrct.ac.in**



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| 60 PDS E34 | Blockchain in AI and IoT | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To understand the working of IoT and Blockchain
- To identify consensus mechanism and apply Blockchain for IoT sector.
- To use Hyper ledger Fabric and Ethereum platform to implement Blockchain applications.
- To understand the machine learning techniques, the function of Blockchain and AI
- To develop the future of AI with Blockchain

**Prerequisite**

Basic knowledge of Internet of things and Artificial Intelligence.

**Course Outcomes**

**On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| **CO1** | Apply Hyperledger Fabric and Ethereum platform to implement the Block Chain Application | Apply |
| **CO2** | Demonstrate the working of IoT and Blockchain | Create |
| **CO3** | Identify Consensus mechanism for Blockchain Application | Evaluate |
| **CO4** | Provide conceptual understanding of the function of Blockchain & AI as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable. | Create |
| **CO5** | Develop techniques in information science applications by applying Computational intelligence and appropriate machine learning techniques in Blockchain | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | 3 |
| **CO4** | 3 | 2 | 3 | 3 | 2 | 2 |
| **CO5** | 3 | 2 | 3 | 3 | 2 | 3 |
| **3-Strong; 2-Medium; 1-Some** | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 20 | 10 | 30 |
| Understand(Un) | 10 | 00 | 10 |
| Apply (Ap) | 10 | 20 | 40 |
| Analyse (An) | 10 | 20 | 20 |
| Evaluate(Ev) | 10 | 00 | 00 |
| Create(Cr) | 00 | 10 | 00 |



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| 60 PDS E34 - Blockchain in AI and IoT | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PDS: M.Tech Data Science | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Overview of Blockchain**<br>Getting Started with Blockchain: Blockchain versus distributed ledger technology versus distributed databases - Comparing the technologies with examples - Public versus private versus permissioned Blockchain - Comparing usage scenarios - Privacy in Blockchain - Understanding Bitcoin - A brief overview of Bitcoin, Ethereum: A brief overview of Ethereum, Introduction to Hyperledger - Overview of the project - Hyperledger Fabric - Hyperledger Saw tooth - Other Hyperledger frameworks and tools. | [9] |
| **Introduction to IoT & Blockchain**<br>Introduction to Internet of Things (IoT)- Concepts and definitions of IoT-History of IoT –IoT vs Conventional Network-IoT Architecture- Introduction to Blockchain-Generations of Blockchain Structure of Blockchain-Opportunities and challenges in IoT and Blockchain. | [9] |
| **Blockchain Usecases in IoT sector**<br>Autonomous Decentralized peer to peer telemetry-Blockchain Enabled Security for Smart cities Blockchain Enabled Smart Home Architecture-Blockchain based self-managed VANETs-Security and privacy of data | [9] |
| **Blockchain and Artificial Intelligence**<br>Domain Specific Applications - Applying AI & Blockchain: Healthcare, Supply chain, Financial Services, Information Security, Document management, AI & Blockchain Driven Databases - Centralized versus distributed data, Big data for AI analysis, Data Management in a DAO, Emerging patterns for Database Solutions | [9] |
| **Developing and Future of AI with Blockchains**<br>Applying SDLC practices in Blockchain: Introduction to DIApp - Architecture of a DIApp - Developing a DIApp - Testing a DIApp - Deploying DIApp - Monitoring a DIApp, Implementing DIApp - Evolution of decentralized applications, building a sample DIApp, Developing Smart Contracts, Solution approach with AI, Developing: Client code, Backend, Frontend, Future of converging AI & Blockchain in enterprises & Government. | [9] |
| **Total Hours** | **45** |

**Text book(s):**

1. Brojo Kishore Mishra, Sanjay Kumar Kuanar 'Handbook of IoT and Blockchain: Methods, Solutions, and Recent Advancements (Internet of Everything (IoE)) ', CRC Press; 1st Edition , November 2020.
2. Ganesh Prasad Kumble, 'Practical Aritifical Intelligence and Blockchain', 1st Edition, Packt Publishing Lts, July 2020.

**Reference(s):**

1. John Soldatos, 'Building Blocks for IoT Analytics', River Publishers,2016
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, 'Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction', Princeton University Press,2016
3. https://www.velmie.com/practical-blockchain-study
4. https://www.researchgate.net/publication/337649428_Handbook_of_IoT_and_Blockchain_Methods_Solutions_and_Recent_Advancements

**Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| 1 | **Overview of Blockchain** | |
| 1.1 | Getting Started with Blockchain: Blockchain versus distributed ledger technology versus distributed databases | 1 |
| 1.2 | Comparing the technologies with examples | 1 |
| 1.3 | Public versus private versus permissioned Blockchain | 1 |
| 1.4 | Comparing usage scenarios | 1 |
| 1.5 | Privacy in Blockchain - Understanding Bitcoin | 1 |
| 1.6 | A brief overview of Bitcoin, Ethereum: A brief overview of Ethereum, Introduction to | 1 |



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| | | |
|---|---|---|
| | Hyperledger | |
| 1.7 | Overview of the project - Hyperledger Fabric | 1 |
| 1.8 | Hyperledger Saw tooth | 1 |
| 1.9 | Other Hyperledger frameworks and tools | 1 |
| **2** | **Introduction to IoT & Blockchain** | |
| 2.1 | Introduction to Internet of Things (IoT) | 1 |
| 2.2 | Concepts and definitions of IoT | 1 |
| 2.3 | History of IoT –IoT vs Conventional Network | 1 |
| 2.4 | IoT Architecture- | 1 |
| 2.5 | Introduction to Blockchain | 1 |
| 2.6 | Generations of BlockchainStructure of Blockchain | 2 |
| 2.7 | Opportunities and challenges in IoT and Blockchain | 2 |
| **3** | **Blockchain Usecases in IoT Sector** | |
| 3.1 | Autonomous Decentralized peer to peer telemetry | 1 |
| 3.2 | Blockchain Enabled Security for Smart cities Blockchain Enabled | 2 |
| 3.3 | Smart Home Architecture | 2 |
| 3.4 | Blockchain based self | 1 |
| 3.5 | managed VANETs | 1 |
| 3.6 | Security and privacy of data | 2 |
| **4** | **Blockchain and Artificial Intelligence** | |
| 4.1 | Domain Specific Applications | 1 |
| 4.2 | Applying AI & Blockchain Healthcare, Supply chain, Financial Services, Information Security | 2 |
| 4.3 | Document management | 1 |
| 4.4 | AI & Blockchain Driven Databases | 1 |
| 4.5 | Centralized versus distributed data | 1 |
| 4.6 | Big data for AI analysis | 1 |
| 4.7 | Data Management in a DAO | 1 |
| 4.8 | Emerging patterns for Database Solutions | 1 |
| **5** | **Developing and Future of AI with Blockchains** | |
| 5.1 | Applying SDLC practices in Blockchain: : Introduction to DIApp | 1 |
| 5.2 | Architecture of a DIApp | 1 |
| 5.3 | Developing a DIApp | 1 |
| 5.4 | Testing a DIApp- Deploying DIApp | 1 |
| 5.5 | Monitoring a DIApp, Implementing DIApp | 1 |
| 5.6 | Evolution of decentralized applications, building a sample DIApp | 1 |
| 5.7 | Developing Smart Contracts, Solution approach with AI | 1 |
| 5.8 | Developing: Client code, Backend, Frontend | 1 |
| 5.9 | Future of converging AI & Blockchain in enterprises & Government | 1 |
| | **Total** | **45** |

**Course Designers**

**Ms.B.Manimegalai (manimegalai@ksrct.ac.in)**

| 60 PDS E35 | Cognitive Science and Analytics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective(s)**

- To study the basic concepts and approaches in the field of cognitive science
- To apply the concepts of planning, reasoning and learning models in cognitive applications
- To analyze language and semantic models of cognitive process
- To Understand the concepts of cognitive development
- To acquire knowledge in language processing & semantics

**Prerequisite**



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Basic knowledge of Artificial Intelligence

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Apply the basic concept of cognitive science | Apply |
| **CO2** | Analyse the learning model and apply the same to appropriate real world applications | Analyse |
| **CO3** | Apply reasoning methodology to real world applications | Apply |
| **CO4** | Create the new concepts of cognitive development & learning | Create |
| **CO5** | Analyse the knowledge in language processing and understanding | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 00 | 00 | 00 |
| Understand (Un) | 40 | 00 | 20 |
| Apply (Ap) | 20 | 30 | 30 |
| Analyze (An) | 00 | 20 | 30 |
| Evaluate(Ev) | 00 | 00 | 00 |
| Create (Cr) | 00 | 10 | 20 |



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**K.S.Rangasamy College of Technology – Autonomous R2022**

**60 PDS E35 - Cognitive Science and Analytics**

**PDS: M.Tech Data Science**

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| II | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Cognitive Science**<br>Fundamental Concepts of cognitive science – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – Artificial Intelligence: Knowledge representation, semantic networks, frames, conceptual dependency, scripts, Ontology Understanding, Common Sense Reasoning. | [9] |
| **Planning and Learning Methods**<br>Planning – Situation Logic- Learning in Cognitive Systems- Rote Learning – Learning by Examples - Incremental Concept Learning – Inductive Learning - Classification Techniques – Statistical Reasoning- Bayesian Classification- Bayesian Networks- Concept Learning- Version Spaces - Discrimination Trees. | [9] |
| **Reasoning methods & Cognitive Modeling**<br>Reasoning by analogy – Explanation based reasoning – Case based reasoning- Constraint Satisfaction- Constraint Propagation- Temporal reasoning – Temporal Constraint Networks Spatial reasoning- Visual Spatial reasoning- Meta reasoning – Learning by correcting mistakes AI ethics, Declarative/ logic-based computational cognitive modelling - connectionist models of cognition - Bayesian models of cognition - Cognitive Models of Memory and Language - Computational models of episodic and semantic memory - modelling psycholinguistics (with emphasis on lexical semantics) - towards deep understanding - modelling the interaction of language, memory and learning. | [9] |
| **Cognitive Development**<br>Child concept acquisition - Child language learning - Acquisition of arithmetic skills – Distributed Cognition and Learning- Simple and Complex Decision Making – Reasoning Under Uncertainty – Natural Language Understanding – Natural Language Processing – Automated Natural Language Generation. | [9] |
| **Language and Semantic Processing**<br>Knowledge Acquisition – Semantics in Cognitive Science – Meaning and Entailment – Cognitive and Computational Models of Semantic Processing – Information Processing Models of the Mind Physical symbol systems and language of thought- Applying the Symbolic Paradigm- Neural networks and distributed information processing- Neural network models of Cognitive Processes Dynamical systems and situated cognition. | [9] |
| **Total Hours** | **45** |

**Text book(s):**


| | |
|---|---|
| 1. | Jose Luis Bermudez, “Cognitive Science: An Introduction to the Science of the Mind”, Cambridge University Press, New York, 2014. |
| 2. | Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing”, IGI Global Publishers, 2019. |


**Reference(s):**


| | |
|---|---|
| 1. | Stuart J. Russell, Peter Norvig, “Artificial Intelligence - A Modern Approach”, Third Edition, Pearson Publishers, 2015. |
| 2. | Paul Miller, “An Introductory Course in Computational Neuroscience”, MIT Press, 2018. |
| 3. | Jerome R. Busemeyer, Zheng Wang, James T. Townsend, Ami Eidels(Ed), “The Oxford Handbook of Computational and Mathematical Psychology”,Oxford University Press (2015). |
| 4. | Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, “Cognitive Science: An Introduction”, Second Edition, MIT press ,1995. |


**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|

Rev. No.3/w.e.f. 22.07.2024 Approved Passed in BoS Meeting held on 24/05/2024in Academic Council Meeting held on 25/05/2024

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| | | |
|---|---|---|
| **1** | **Introduction to Cognitive Science** | |
| 1.1 | Fundamental Concepts of cognitive science | 1 |
| 1.2 | Computers in Cognitive Science | 1 |
| 1.3 | Applied Cognitive Science | 1 |
| 1.4 | The Interdisciplinary Nature of Cognitive Science | 1 |
| 1.5 | Artificial Intelligence: Knowledge representation | 1 |
| 1.6 | semantic networks, frames | 1 |
| 1.7 | conceptual dependency, scripts | 1 |
| 1.8 | Ontology Understanding | 1 |
| 1.9 | Common Sense Reasoning. | 1 |
| **2** | **Planning and Learning Methods** | |
| 2.1 | Planning – Situation Logic | 1 |
| 2.2 | Learning in Cognitive Systems | 1 |
| 2.3 | Rote Learning – Learning by Examples | 1 |
| 2.4 | Incremental Concept Learning – Inductive Learning | 1 |
| 2.5 | Classification Techniques – Statistical Reasoning | 1 |
| 2.6 | Bayesian Classification | 1 |
| 2.7 | Bayesian Networks | 1 |
| 2.8 | Concept Learning- Version Spaces | 1 |
| 2.9 | Discrimination Trees. | 1 |
| **3** | **Reasoning methods & Cognitive Modeling** | |
| 3.1 | Reasoning by analogy – Explanation based reasoning – Case based reasoning | 1 |
| 3.2 | Constraint Satisfaction- Constraint Propagation- Temporal reasoning | 1 |
| 3.3 | Temporal Constraint Networks Spatial reasoning- Visual Spatial reasoning- Meta reasoning | 1 |
| 3.4 | Learning by correcting mistakes AI ethics, Declarative/ logic-based computational cognitive modelling | 1 |
| 3.5 | Connectionist models of cognition - Bayesian models of cognition | 1 |
| 3.6 | Cognitive Models of Memory and Language | 1 |
| 3.7 | Computational models of episodic and semantic memory | 1 |
| 3.8 | Modelling psycholinguistics (with emphasis on lexical semantics) - towards deep understanding | 1 |
| 3.9 | Modelling the interaction of language, memory and learning. | 1 |
| **4** | **Cognitive Development** | |
| 4.1 | Child concept acquisition | 1 |
| 4.2 | Child language learning | 1 |
| 4.3 | Acquisition of arithmetic skills | 1 |
| 4.4 | Distributed Cognition and Learning | 1 |
| 4.5 | Simple and Complex Decision Making | 1 |
| 4.6 | Reasoning Under Uncertainty | 1 |



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| | | |
|---|---|---|
| 4.7 | Natural Language Understanding | 1 |
| 4.8 | Natural Language Processing | 1 |
| 4.9 | Automated Natural Language Generation. | 1 |
| **5** | **Language and Semantic Processing** | |
| 5.1 | Knowledge Acquisition | 1 |
| 5.2 | Semantics in Cognitive Science | 1 |
| 5.3 | Meaning and Entailment | 1 |
| 5.4 | Cognitive and Computational Models of Semantic Processing | 1 |
| 5.5 | Information Processing Models of the Mind Physical symbol systems and language of thought | 2 |
| 5.6 | Applying the Symbolic Paradigm | 1 |
| 5.7 | Neural networks and distributed information processing | 1 |
| 5.8 | Neural network models of Cognitive Processes Dynamical systems and situated cognition. | 1 |
| | **Total** | **45** |

**Course Designers**

**Mr.R.Arunkumar (rarunkumar@ksrct.ac.in)**



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| 60 PAC 001 | English for Research Paper Writing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | AC | 2 | 0 | 0 | 2 |

**Objective(s)**

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

**Prerequisite**

NIL

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Understand that how to improve your writing skills and level of readability | Understand |
| **CO2** | Learn about what to write in each section | Remember |
| **CO3** | Understand the skills needed when writing a Title | Understand |
| **CO4** | Understand the skills needed when writing the Conclusion | Understand |
| **CO5** | Ensure the good quality of paper at very first-time submission | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests(Marks) | |
|---|---|---|
| | **1** | **2** |
| Remember(Re) | 30 | 30 |
| Understand(Un) | 30 | 30 |
| Apply(Ap) | - | - |
| Analyse(An) | - | - |
| Evaluate(Ev) | - | - |
| Create(Cr) | - | - |
| Total | 60 | 60 |



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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PAC 001 - English for Research Paper Writing** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| I / II | 2 | 0 | 0 | 30 | 0 | 100 | - | 100 |

| | |
|---|---|
| **Introduction to Research Paper Writing**Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness | [6] |
| **Presentation Skills**Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction | [6] |
| **Title Writing Skills**<br>Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check | [6] |
| **Result Writing Skills**<br>Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions | [6] |
| **Verification Skills**<br>Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first time submission | [6] |
| **Total Hours** | **30** |

| **Text Book(s):** | |
|---|---|
| 1. | Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011 |
| 2 | Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006 |
| **Reference(s):** | |
| 1. | Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006 |
| 2. | Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998. |
| 3. | Phill Williams, Advanced Writing skills for students of English, Rumian Publishers, 2018 |
| 4. | Sudhir S. Pandhye, English Grammar and Writing Skills, Notion Press, 2017. |



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| 60 PAC 002 | Disaster Management | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | AC | 2 | 0 | 0 | 0 |

**Objective(s)**

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches Teach how to improve writing skills and level of readability

**Prerequisite**

Nil

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Understand that how to improve your writing skills and level of readability | Understand |
| **CO2** | Learn about what to write in each section | Remember |
| **CO3** | Understand the skills needed when writing a Title | Understand |
| **CO4** | Understand the skills needed when writing the Conclusion | Understand |
| **CO5** | Ensure the good quality of paper at very first-time submission | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 3 |

**3-Strong; 2-Medium; 1-Some**

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests(Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 30 | 30 | 30 |
| Understand(Un) | 30 | 30 | 40 |
| Apply(Ap) | - | - | 30 |
| Analyse(An) | - | - | - |
| Evaluate(Ev) | - | - | - |
| Create(Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PAC 002 – Disaster Management** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 2 | 0 | 0 | 30 | 0 | 100 | - | 100 |

| | |
|---|---|
| **Introduction**<br>Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. | [6] |
| **Repercussions of Disasters and Hazards**Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts. | [6] |
| **Disaster Prone Areas In India**Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics | [6] |
| **Disaster Preparedness and Management**Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other Agencies, Media Reports: Governmental and Community Preparedness. | [6] |
| **Risk Assessment**Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. | [6] |
| **Total Hours** | **30** |

| **Text Book(s):** | |
|---|---|
| 1. | Goel S. L., Disaster Administration and Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi,2009. |
| 2 | Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company,2007. |
| **Reference(s):** | |
| 1. | Sahni, Pardeep et.al.," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, 2001. |
| 2. | Subramanian R,"Disaster Management", Vikas publishing Housing Pvt. Ltd., 2018. |
| 3. | Chu-hua Kuei, Christian N Madu, Handbook of Disaster Management Risk Reduction & Management: Climate change and Natural Disaster, world scientific, 2017. |
| 4. | Janki Andharia, Disaster studies: Exploring Intersectional ties in Disaster Discourse, Springer, 2020. |



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| 60 PAC 003 | Constitution of India | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | AC | 2 | 0 | 0 | 0 |

**Objective(s)**

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional.
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in1917 and its impact on the initial drafting of the Indian Constitution.

**Prerequisite**

NIL

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| **CO1** | Understand that how to improve your writing skills and level of readability | Understand |
| **CO2** | Learn about what to write in each section | Remember |
| **CO3** | Understand the skills needed when writing a Title | Understand |
| **CO4** | Understand the skills needed when writing the Conclusion | Understand |
| **CO5** | Ensure the good quality of paper at very first-time submission | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | 2 | 3 |
| **CO2** | 3 | 3 | 2 | 3 | 3 | 2 |
| **CO3** | 3 | 3 | 2 | 3 | 3 | 3 |
| **CO4** | 3 | 3 | 2 | 3 | 2 | 2 |
| **CO5** | 3 | 3 | 2 | 2 | 2 | 3 |
| **3-Strong; 2-Medium; 1-Some** | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests(Marks) | |
|---|---|---|
| | **1** | **2** |
| Remember(Re) | 30 | 30 |
| Understand(Un) | 30 | 30 |
| Apply(Ap) | - | - |
| Analyse(An) | - | - |
| Evaluate(Ev) | - | - |
| Create(Cr) | - | - |
| Total | 60 | 60 |



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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PAC 003 – Constitution of India** | | | | | | | | |
| **Common to all Branches** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| II | 2 | 0 | 0 | 30 | 0 | 100 | - | 100 |

| | |
|---|---|
| **History of Making of The Indian Constitution**<br>History, Drafting Committee, (Composition & Working) | [3] |
| **Philosophy of The Indian Constitution**<br>Preamble, Salient Features | [3] |
| **Contours of Constitutional Rights and Duties**<br>Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties. | [6] |
| **Organs of Governance**<br>Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions. | [6] |
| **Local Administration**<br>District's Administration head: Role and Importance Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy. | [6] |
| **Election Commission**<br>Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women. | [6] |
| **Total Hours** | **30** |

| **Text Book(s):** | |
|---|---|
| 1. | The Constitution of India,1950 (Bare Act),Government Publication. |
| 2 | Busi S N, Ambedkar B R, "Framing of Indian Constitution",1st Edition, 2015. |
| **Reference(s):** | |
| 1. | Jain, M P, "Indian Constitution Law", 7th Edition, Lexis Nexis,2014 |
| 2. | Basu, D D, "Introduction to the Constitution of India", Lexis Nexis, 2015. |
| 3. | Bhansali S R., "Textbook on The Constitution of India", Universal Publishers, 2015 |
| 4. | Jain, M P., "Outlines of Indian Legal and Constitutional History", Lexis Nexis, 2014 |



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**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE-637215**

**(An Autonomous Institution affiliated to Anna University)**

**M. Tech. Degree Programme**

**SCHEME OF EXAMINATIONS**

**(For the candidates admitted in 2024 - 2025)**

**THIRD SEMESTER**

| S.No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment * | End Semester Exam ** | Max. Marks | End Semester Exam | Total |
| **THEORY** | | | | | | | | |
| 1. | 60 PDS 301 | Deep Learning | 2 | 40 | 60 | 100 | 45 | 100 |
| 2. | 60 PDS E4* | Professional Elective IV | 2 | 40 | 60 | 100 | 45 | 100 |
| 3. | 60 PDS E5* | Professional Elective V | 2 | 40 | 60 | 100 | 45 | 100 |
| 4. | 60 PDS E6* | Professional Elective VI | 2 | 40 | 60 | 100 | 45 | 100 |
| **PRCTICAL** | | | | | | | | |
| 5. | 60 PDS 3P1 | Project Work Phase - I | 2 | 100 | | 100 | | 100 |

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination.



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| 60 PDS 301 | Deep Learning | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 1 | 0 | 4 |

## Objective

- To learn the basic concepts of deep learning
- To familiarize the different deep learning architectures
- To provide connection between the concepts of deep learning in Genomics and Biomedicine
- To develop the skill to apply data driven techniques in the Biomedical domain
- To implement NLP applications using deep learning algorithms

## Prerequisite

Basic knowledge of Probability & Statistics, Artificial Intelligence and Machine Learning

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explore the fundamentals of deep learning implementation | Understand |
| CO2 | Analyse different deep learning architectures | Analyse |
| CO3 | Apply the role of Deep learning in Genomics and Biomedicine | Apply |
| CO4 | Implement different deep learning architectures for point of care disease diagnosis | Apply |
| CO5 | Utilize different deep learning architectures to solve real-time NLP problems | Apply |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO5 | 2 | 2 | 3 | 3 | 2 | 2 |
| 3-Strong;2-Medium;1-Some | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 20 | 20 | 20 |
| Understand (Un) | 20 | 20 | 30 |
| Apply (Ap) | - | 20 | 30 |
| Analyse (An) | 20 | - | 20 |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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**60 PDS 301 - DEEP LEARNING**

**PDS: M.TECH DATA SCIENCE**

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 1 | 0 | 60 | 4 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Deep Learning**<br>History of Deep learning - Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Regularization – Dropout | [9] |
| **Deep Learning Architectures**<br>Convolutional Neural Networks Architectures – Convolution – Pooling Layers – Transfer Learning –Long Short Term Memory, Gated Recurrent Units, Encoder/Decoder Architectures – Auto encoders – Standard- Sparse – Denoising –Contractive- Variational Auto encoders – Adversarial Generative Networks | [9] |
| **Deep Learning in Genomics and Biomedicine**<br>Genomics – Dense Nets and Convolutional Nets for Genomics - Recurrent NN – Autoen coders and representation learning - Generative Models –Drug Discovery and protein structure: - imaging and electronic medical records-Molecule Net – One shot Learning drug discovery - Case Studies | [9] |
| **Deep Learning for Biomedical Data Analysis**<br>Understanding and Visualizing Convolutional Neural Networks Lenet, Alexnet, Google net for visual perception tasks- Point of care disease diagnosis using CNN – Capsule Network- Generative Adversarial Networks - Case Studies | [9] |
| **Deep Learning for NLP**<br>Words - Regular Expressions - N-grams - Language modelling - Part-of-Speech Tagging - Named Entity Recognition - Topic classification - Syntactic Parsing -Dependency Parsing - Computational Semantics - Lexical Semantics - Vector space models - Bag-of-Words - Term Frequency - Inverse Document Frequency - Attention mechanism - Transformer networks - Convolutional Neural Networks for text classification - Machine Translation | [9] |
| **Practice:**<br>1. Collect data sets from the url : http://deeplearning.net/datasets/<br>2. Image processing using CNN<br>3. Text analysis (Next word prediction, etc) using RNN<br>4. Text classification using RNN<br>5. Sentiment Classification using RNN<br>6. Disease Diagnosis using CNN<br>7. Deep learning in genomics | [15] |
| **Total Hours=45+15(Tutorial)** | **60** |

**Text book(s)**

| | |
|---|---|
| 1. | Ian Good Fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017. |
| 2. | Adam Gibson, Josh Patterson, ’Deep Learning: A Practitioner's Approach’, OReilly, 2016. |

**Reference(s):**

| | |
|---|---|
| 1. | Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018. |
| 2. | Yoshua Bengio, “Learning Deep Architectures for AI”, Foundations & Trends in Machine Learning, 2009 |
| 3. | Nicholas Locascio and Nikhil Buduma "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", OReilly, 2017. |
| 4. | Yoav Goldberg, Neural Network Methods for Natural Language Processing, Synthesis Lectures on Human Language Technologies, Morgan & Claypool Publishers, 2017. |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction to Deep Learning** | |
| 1.1 | History of Deep learning | 1 |
| 1.2 | Feed Forward Neural Networks | 1 |
| 1.3 | Gradient Descent | 1 |
| 1.4 | Back Propagation Algorithm | 1 |
| 1.5 | Vanishing Gradient problem | 1 |
| 1.6 | Heuristics for Avoiding Bad Local Minima | 1 |
| 1.7 | Heuristics for Faster Training | 1 |
| 1.8 | Regularization | 1 |
| 1.9 | Dropout | 1 |
| **2** | **Deep Learning Architectures** | |
| 2.1 | Convolutional Neural Networks Architectures | 1 |
| 2.2 | Convolution – Pooling Layers | 1 |
| 2.3 | Transfer Learning | 1 |
| 2.4 | Long Short Term Memory, Gated Recurrent Units | 1 |
| 2.5 | Encoder/Decoder Architectures | 1 |
| 2.6 | Autoencoders | 1 |
| 2.7 | Standard- Sparse – Denoising , Contractive | 1 |
| 2.8 | Variational Autoencoders | 1 |
| 2.9 | Adversarial Generative Networks | 1 |
| **3** | **Deep Learning in Genomics and Biomedicine** | |
| 3.1 | Genomics | 1 |
| 3.2 | DenseNets and Convolutional Nets for Genomics | 1 |
| 3.3 | Recurrent NN | 2 |
| 3.4 | Autoencoders and representation learning | 1 |
| 3.5 | Generative Models | 1 |
| 3.6 | Drug Discovery and protein structure: - imaging and electronic medical records | 1 |
| 3.7 | MoleculeNet | 1 |
| 3.8 | One shot Learning drug discovery | 1 |
| 3.9 | Case Studies | 1 |
| **4** | **Deep Learning for Biomedical Data Analysis** | |
| 4.1 | Understanding and Visualizing Convolutional Neural Networks | 1 |
| 4.2 | Lenet, Alexnet | 2 |
| 4.3 | GoogleNet for Visual perception tasks | 2 |
| 4.4 | Point of care disease diagnosis using CNN | 1 |
| 4.5 | Capsule Network | 1 |
| 4.6 | Generative Adversarial Networks | 1 |
| 4.7 | Case Studies | 1 |
| **5** | **Deep Learning for NLP** | |
| 5.1 | Words - Regular Expressions - N-grams | 1 |
| 5.2 | Language modelling - Part-of-Speech Tagging - | 1 |
| 5.3 | Named Entity Recognition | 1 |
| 5.4 | Topic classification - Syntactic Parsing -Dependency Parsing | 1 |
| 5.5 | Computational Semantics - Lexical Semantics - Vector space models - Bag-of-Words | 2 |

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Meeting held on 24/05/2024in Academic Council Meeting
held on 25/05/2024

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| | | |
|---|---|---|
| 5.6 | Term Frequency - Inverse Document Frequency - Attention mechanism | 1 |
| 5.7 | Transformer networks - Convolutional Neural Networks for text classification | 1 |
| 5.8 | Machine Translation | 1 |
| **Practice** | | |
| P.1 | Collect data sets from the url : http://deeplearning.net/datasets/ | 1 |
| P.2 | Image processing using CNN | 2 |
| P.3 | Text analysis (Next word prediction,etc) using RNN | 2 |
| P.4 | Text classification using RNN | 2 |
| P.5 | Sentiment Classification using RNN | 2 |
| P.6 | Disease Diagnosis using CNN | 3 |
| P.7 | Deep learning in genomics | 3 |
| | **Total** | **45 + 15 = 60** |

## Course Designers

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| 60 PDS E41 | Pattern Recognition | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objectives

- To learn about supervised and unsupervised pattern classifiers
- To analyze the different clustering concepts
- To familiarize the different feature extraction and selection techniques
- To explore the role of Hidden Markov models and SVM
- To investigate the application of fuzzy logic and genetic algorithm in pattern recognition

## Prerequisite

Basic knowledge of Digital logic circuit, Machine Learning, Cloud Computing.

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Interpret the mathematics related to Pattern recognition | Apply |
| CO2 | Analyse the behavior of Clustering and Classification | Analyse |
| CO3 | Apply methods for feature extraction and selection | Apply |
| CO4 | Develop the models using support vector machines | Apply |
| CO5 | Apply the recent advances in pattern recognition | Apply |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | 3 | 2 |
| CO2 | 2 | 2 | 3 | 3 | 3 | - |
| CO3 | 2 | 2 | 3 | 3 | 3 | - |
| CO4 | 2 | 2 | 3 | 2 | 3 | - |
| CO5 | 2 | 2 | 3 | 3 | 2 | - |

3-Strong;2-Medium;1-Some

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 10 | 20 | 20 |
| Understand (Un) | 10 | 20 | 20 |
| Apply (Ap) | 20 | 20 | 40 |
| Analyse (An) | 20 | - | 20 |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 PDS E41-Pattern Recognition | | | | | | | | |
| PDS: M.TECH DATA SCIENCE | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Pattern Classifier**<br>Introduction and Mathematical preliminaries -- Overview of Pattern recognition – Discriminant functions – Supervised learning –Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Pattern classification by distance functions – Minimum distance pattern classifier. | **[9]** |
| **Clustering**<br>Clustering for unsupervised learning and classification – Clustering concept – C Means algorithm – Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters. | **[9]** |
| **Feature Extraction and Structural Pattern Recognition**<br>KL Transforms – Feature selection through functional approximation – Binary selection -Elements of formal grammars - Syntactic description - Stochastic grammars - Structural representation. | **[9]** |
| **Hidden Markov Models and Support Vector Machine**<br>State Machines – Hidden Markov Models – Training – Classification – Support vector Machine –Feature Selection. | **[9]** |
| **Recent Advances**<br>Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study UsingFuzzy Pattern Classifiers and Perception. | **[9]** |
| **Total Hours** | **45** |

**Textbook(s):**


1. M Narasimha Murthy and V Susheela Devi, ‘Pattern Recognition’, Springer 2011.
2. Richard O. Duda, Peter E. Hard, David G. Stork , “ Pattern Recognition”, Second Edition, John Wiley& Sons, 2021


**Reference(s):**


1. C M Bishop, ‘Pattern Recognition and Machine Learning’, Springer, 2010.
2. David Barber,’Bayesian Reasoning and Machine Learning’, Cambridge University Press, 2019.
3. Richard O. Duda, ‘Pattern Classification’, Second Edition, JohnWiley& Sons, 2000.
4. Valliappa Lakshmanan, Martin Goerner, Ryan Gillard, ‘Practical Machine Learning for Computer Vision: End to End Machine Learning for Images’, O’Reilly Media, Inc, USA, 2021.




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## Course Contents and Lecture Schedule

| S.No. | Topic | No. of Hours |
|---|---|---|
| **1.0** | **Pattern Classifier** | |
| 1.1 | Introduction and Mathematical preliminaries | 1 |
| 1.2 | Overview of Pattern recognition | 1 |
| 1.3 | Discriminant functions | 1 |
| 1.4 | Supervised learning | 1 |
| 1.5 | Parametric estimation | 1 |
| 1.6 | Maximum Likelihood Estimation | 1 |
| 1.7 | Bayesian parameter Estimation | 1 |
| 1.8 | Pattern classification by distance functions | 1 |
| 1.9 | Minimum distance pattern classifier | 1 |
| **2.0** | **Clustering** | |
| 2.1 | Clustering for unsupervised learning and classification | 2 |
| 2.2 | Clustering concept | 1 |
| 2.3 | C Means algorithm | 2 |
| 2.4 | Hierarchical clustering | 1 |
| 2.5 | Graph theoretic approach to pattern Clustering | 2 |
| 2.6 | Validity of Clusters | 1 |
| **3.0** | **Feature Extraction and Structural Pattern Recognition** | |
| 3.1 | KL Transforms | 1 |
| 3.2 | Feature selection through functional approximation | 2 |
| 3.3 | Binary selection | 1 |
| 3.4 | Elements of formal grammars | 2 |
| 3.5 | Syntactic description | 1 |
| 3.6 | Stochastic grammars | 1 |
| 3.7 | Structural representation | 1 |
| **4.0** | **Hidden Markov Models and Support Vector Machine** | |
| 4.1 | State Machines | 1 |
| 4.2 | Hidden Markov Models | 2 |
| 4.3 | Training | 2 |
| 4.4 | Classification | 1 |
| 4.5 | Support vector Machine | 2 |
| 4.6 | Feature Selection | 1 |
| **5.0** | **Recent Advances** | |
| 5.1 | Fuzzy logic | 1 |
| 5.2 | Fuzzy Pattern Classifiers | 2 |
| 5.3 | Pattern Classification using Genetic Algorithms | 3 |
| 5.4 | Case Study Using Fuzzy Pattern Classifiers and Perception | 3 |
| | **Total** | **45** |

## Course Designers

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| 60 PDS E42 | IoT Architecture and Computing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objectives

- To Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and Real World Design Constraints
- To Understand the various IoT Protocols (Datalink, Network, Transport, Session, Service
- To build an ecosystem of networked devices that can detect, touch, and interact
- To enables us to make use of all of the data created by IoT by allowing us to interact with our organization from anywhere, at any time

## Prerequisite

Basic knowledge of

## Course Outcomes

- On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Describe the term IoT in different contexts. | Remember, |
| CO2 | Analyse various protocols for IoT. | Evaluate |
| CO3 | Design a PoC of an IoT system using Rasperry Pi/Arduino | Create |
| CO4 | Apply data analytics and use cloud offerings related to IoT. | Apply |
| CO5 | Analyze applications of IoT in real time scenario | Analyse |

## Mapping with Programme Outcomes

| COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | 2 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 2 |
| CO3 | 2 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 20 | 10 | 20 |
| Understand (Un) | 00 | 10 | 10 |
| Apply (Ap) | 20 | 10 | 10 |
| Analyse (An) | 10 | 20 | 20 |
| Evaluate (Ev) | 10 | 10 | 10 |
| Create (Cr) | 00 | 00 | 30 |

| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PDS E42- IoT Architecture and Computing** | | | | | | | | |
| **PDS: M.TECH DATA SCIENCE** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **OVERVIEW**<br>IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management | [9] |
| **REFERENCE ARCHITECTURE**<br>IoT Architecture-State of the Art – Introduction, State of the art, Reference Model architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. | [9] |
| **IOT DATA LINK LAYER, NETWORK LAYER, TRANSPORT PROTOCOLS**<br>PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z-Wave, Bluetooth Low Energy, Zig bee Smart Energy, DASH7 - Network Layer-IPv4,IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP- Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – | [9] |
| **Application Protocols for IoT**: UPnP, CoAP, MQTT, XMPP. SCADA, Web Socket; IP-based protocols: 6LoWPAN, RPL; Authentication Protocols; IEEE 802.15.4 | [9] |
| **Case study**: Cloud-Based Smart-Facilities Management, Healthcare, Environment Monitoring System. | [9] |
| **Total Hours** | **45** |

| **Text book(s):** | |
|---|---|
| 1. | Bassi, Alessandro, et al, 'Enabling things to talk', Springer-Verlag Berlin An, 2016. |
| 2. | David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, 'IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things', CISCO Press, 2017 |
| **Reference(s):** | |
| 1. | Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, 'From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence', First Edition, Academic Press, 2014. |
| 2. | Bernd Scholz-Reiter, Florian Michahelles, 'Architecting the Internet of Things', ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer |
| 3. | Daniel Minoli, 'Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications', ISBN: 978-1-118-47347-4, Willy Publications |
| 4. | Vijay Madisetti and ArshdeepBahga, 'Internet of Things (A Hands-on-Approach)' , First Edition, VPT, 2014 |



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| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **OVERVIEW** | |
| 1.1 | IoT-An Architectural Overview | 1 |
| 1.2 | Building an architecture, Main design principles and needed capabilities | 1 |
| 1.3 | An IoT architecture outline, standards considerations | 1 |
| 1.4 | M2M and IoT Technology Fundamentals | 1 |
| 1.5 | Devices and gateways, Local and wide area networking | 1 |
| 1.6 | Data management, Business processes in IoT | 1 |
| 1.7 | Everything as a Service(XaaS) | 2 |
| 1.8 | M2M and IoT Analytics, Knowledge Management | 1 |
| **2** | **REFERENCE ARCHITECTURE** | |
| 2.1 | IoT Architecture-State of the Art | 1 |
| 2.2 | Introduction, State of the art, Reference Model architecture | 1 |
| 2.3 | IoT reference Model - IoT Reference Architecture | 1 |
| 2.4 | Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views | 1 |
| 2.5 | Real-World Design Constraints | 1 |
| 2.6 | Introduction, Technical Design constraints | 1 |
| 2.7 | hardware is popular again | 1 |
| 2.8 | Data representation and visualization | 1 |
| 2.9 | Interaction and remote control | 1 |
| **3** | **IOT DATA LINK LAYER, NETWORK LAYER, TRANSPORT PROTOCOLS** | 1 |
| 3.1 | PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15) | 1 |
| 3.2 | Wireless HART,Z-Wave, Bluetooth Low Energy | 2 |
| 3.3 | Zig bee Smart Energy | 1 |
| 3.4 | DASH7 - Network Layer-IPv4,IPv6 | 1 |
| 3.5 | 6LoWPAN, 6TiSCH,ND, DHCP, ICMP | 1 |
| 3.6 | RPL, CORPL, CARP | 1 |
| 3.7 | Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS | 2 |
| **4** | **APPLICATION PROTOCOLS FOR IOT** | 1 |
| 4.1 | UPnP, COAP, MQTT | 2 |
| 4.2 | XMPP. SCADA, Web Socket | 1 |
| 4.3 | IP-based protocols | 1 |
| 4.4 | 6LoWPAN, RPL | 1 |
| 4.5 | Authentication Protocols | 2 |
| 4.6 | IEEE 802.15.4 | 1 |
| **5** | **CASE STUDY** | 1 |
| 5.1 | Cloud-Based Smart | 2 |
| 5.2 | Facilities Management | 2 |
| 5.3 | Healthcare | 2 |
| 5.4 | Environment Monitoring System | 2 |
| | Total | 45 |



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| 60 PDS E43 | Advanced Web Analytics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objective

- To understand the Web analytics platform, and their evolution.
- To learn about the various Data Streams Data.
- To learn about the benefit of surveys and capturing of data.
- To understand Common metrics of web as well as KPI related concepts.
- To learn about the various web analytics versions.

## Prerequisite

Basic knowledge of Web Technology, Data Mining, Machine Learning

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the Web analytics platform, and their evolution. | Understand |
| CO2 | Apply the various Data Streams Data. | Apply |
| CO3 | Know how the survey of capturing of data will benefit. | Understand |
| CO4 | Understand Common metrics of web as well as KPI related concepts. | Understand |
| CO5 | Apply various web analytics versions in existence. | Apply |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 2 | 2 |
| 3-Strong;2-Medium;1-Some | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 20 | 30 | 40 |
| Understand(Un) | 20 | 30 | 40 |
| Apply(Ap) | 20 | - | 20 |
| Analyse(An) | - | - | - |
| Evaluate(Ev) | - | - | - |
| Create(Cr) | - | - | - |



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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 60 PDS E43- Advanced Web Analytics | | | | | | | | |
| PDS: M.TECH DATA SCIENCE | | | | | | | | |
| Semester | Hours/Week | | | Total Hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| **III** | **3** | **0** | **0** | **45** | **3** | **40** | **60** | **100** |

Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction**<br>Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, On site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations. | [9] |
| **Data Collection and Qualitative Analysis**: Clickstream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing, Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic<br>Evaluations. | [9] |
| **Web Analytic fundamentals**<br>Capturing data: Web logs or Java Scripts tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, selecting optimal web analytic tool, understanding clickstream data quality, Identifying unique page definition, Using cookies, Link coding issues. | [9] |
| **Web Metrics**<br>**C**ommon metrics**:** Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non e-commerce sites): Improving bounce rates, optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI. | [9] |
| **Web analytics 2.0**<br>Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data ,ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities. | [9] |
| **Total Hours** | 45 |

| **Text Books:** | |
|---|---|
| 1. | Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc. (2010), 2nd ed. |
| 2. | Kaushik A., Web Analytics 2.0 The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. (2010),1st ed. |
| **Reference(s):** | |
| 1. | Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons (2002),1sted |
| 2. | Michael Beasley.,Practical Web Analytics for User Experience , How Analytics can help you Understand Your Users, 2013. |
| 3. | Benjamin Yoskovitz, Lean Analytics: Use Data to Build a better Startup Faster, O Reilly 2013. |
| 4. | Metriken auswerten, Website optimieren, Digital and Web Analytics, Marco Hassler 5., |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No of Hours |
|---|---|---|
| **1** | **Introduction** | |
| 1.1 | Definition, Process, Key terms | 1 |
| 1.2 | Site references, Keywords and Key phrases | 1 |
| 1.3 | building block terms | 1 |
| 1.4 | Visit characterization terms | 1 |
| 1.5 | Content characterization terms | 1 |
| 1.6 | Conversion metrics | 1 |
| 1.7 | Categories: Offsite web, On site web | 1 |
| 1.8 | Web analytics platform, Web analytics evolution | 1 |
| 1.9 | Need for web analytics, Advantages, Limitations | 1 |
| **2** | **Data Collection and Qualitative Analysis** | |
| 2.1 | Clickstream Data: Web logs, Web Beacons | 1 |
| 2.2 | JavaScript tags, Packet Sniffing | 1 |
| 2.3 | Outcomes Data: E-commerce, Lead generation | 1 |
| 2.4 | Brand/Advocacy and Support | 1 |
| 2.5 | Research data: Mindset | 1 |
| 2.6 | Organizational structure | 1 |
| 2.7 | Timing, Heuristic evaluations | 1 |
| 2.8 | Conducting a heuristic evaluation | 1 |
| 2.9 | Benefits of heuristic Evaluations. | 1 |
| **3** | **Web Analytic fundamentals** | |
| 3.1 | Capturing data: Web logs or Java Scripts tags | 1 |
| 3.2 | Separate data serving and data capture | 1 |
| 3.3 | Type and size of data | 1 |
| 3.4 | Integration | 1 |
| 3.5 | Innovation | 1 |
| 3.6 | selecting optimal web analytic tool | 1 |
| 3.7 | understanding clickstream data quality | 1 |
| 3.8 | Identifying unique page definition | 1 |
| 3.9 | Using cookies, Link coding issues. | 1 |
| **4** | **Web Metrics** | |
| 4.1 | **C**ommon metrics**:** Hits, Page views, Visits | 1 |
| 4.2 | Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, new visits | 2 |
| 4.3 | Optimization (e-commerce, non-e-commerce sites) | 1 |

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| | | |
|---|---|---|
| 4.4 | Improving bounce rates, optimizing ad words campaigns | 1 |
| 4.5 | Real time report, Audience report | 1 |
| 4.6 | Traffic source report, Custom campaigns, Content report, Google analytics | 1 |
| 4.7 | Introduction to KPI, characteristics | 1 |
| 4.8 | Need for KPI, Perspective of KPI, Uses of KPI. | 1 |
| **5** | **Web analytics 2.0** | |
| 5.1 | Web analytics 1.0, Limitations of web analytics 1.0 | 1 |
| 5.2 | Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data | 2 |
| 5.3 | ISP data, Search engine data, Hybrid data | 1 |
| 5.4 | Website traffic analysis | 1 |
| 5.5 | Comparing long term traffic trends | 2 |
| 5.6 | Analyzing competitive site overlap and opportunities. | 2 |
| | **Total** | **45** |

**Course Designers**

1.Ms.R.Loga Priya - logapriyar@ksrct.ac.in



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| 60 PDS E44 | Stream Processing and Analytics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objective

- To develop adaptive and responsive applications.
- To help enterprises improve real-time business analytics
- To facilitate faster decisions
- To improve decision-making with increased context
- To create new applications that use a wider variety of data sources.

## Prerequisite

On the successful completion of the course, students will be able to

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explain the need for stream processing | Understand |
| CO2 | Comprehend the architectures of stream processing | Understand |
| CO3 | Explain and run Distributed Processing and Resilience Model | Understand |
| CO4 | Design effective streaming solutions using Structured Streaming | Apply |
| CO5 | Design effective streaming solutions using Spark Streaming | Apply |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 2 | 2 |
| 3-Strong;2-Medium;1-Some | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 30 | 20 | 40 |
| Understand(Un) | 30 | 20 | 40 |
| Apply(Ap) | - | 20 | 20 |
| Analyse(An) | - | - | - |
| Evaluate(Ev) | - | - | - |
| Create(Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS E44- Stream Processing and Analytics | | | | | | | | |
| PDS: M.TECH DATA SCIENCE | | | | | | | | |
| Semester | Hours/Week | | | Total Hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| **III** | **3** | **0** | **0** | **45** | **3** | **40** | **60** | **100** |

Note: The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Introduction To Stream Processing Model**<br>Fundamentals of Stream Processing: What Is Stream Processing? Examples of Stream Processing- Scaling Up Data Processing- Distributed Stream Processing- Introducing Apache Spark. Stream-Processing Model: Sources and Sinks- Immutable Streams Defined from One Another Transformations and Aggregations- Window Aggregations - Stateless and Stateful Processing- The Effect of Time. | [9] |
| **Streaming Architectures**<br>Components of a Data Platform- Architectural Models- The Use of a Batch-Processing Component in a Streaming Application- Referential Streaming Architectures- Streaming Versus Batch Algorithms. Apache Spark as a Stream-Processing Engine: Spark's Memory Usage- Understanding Latency- Throughput Oriented Processing- Fast Implementation of Data Analysis. | [9] |
| **Distributed Processing And Resilience Model**<br>Spark's Distributed Processing Model: Running Apache Spark with a Cluster Manager- Spark's Own Cluster Manager - Resilience and Fault Tolerance in a Distributed System- Data Delivery Semantics- Micro batching and One-Element-at-a-Time - Bringing Microbatch and One-Record-at a- Time Closer Together- Dynamic Batch Interval- Structured Streaming Processing Model. Spark's Resilience Model: Resilient Distributed Datasets in Spark - Spark Components - Spark's Fault-Tolerance Guarantees. | [9] |
| **Structured Streaming**<br>Introducing Structured Streaming- The Structured Streaming Programming Model – Structured Streaming in Action – Structured Streaming Sources – Structured Streaming Sinks - Event Time– Based Stream Processing. | [9] |
| **Spark Streaming**<br>Introducing Spark Streaming - The Spark Streaming Programming Model - The Spark Streaming Execution Model - Spark Streaming Sources - Spark Streaming Sinks - Time-Based Stream Processing- Working with Spark SQL – Check pointing - Monitoring Spark Streaming- Performance Tuning | [9] |
| **Total Hours** | 45 |

**Text Books:**

| | |
|---|---|
| 1. | Gerard Maas and François Garillot , "Stream Processing with Apache Spark: Mastering Structured Streaming and Spark Streaming", O'Reilly, 2019. |
| 2. | Anindita Basak, Krishna Venkataraman, Ryan Murphy, Manpreet Singh, "Stream Analytics with Microsoft Azure", Packt Publishing, December 2017. |

**Reference(s):**

| | |
|---|---|
| 1. | Henrique C. M. Andrade, Buğra Gedik and Deepak S. Turaga, "Fundamentals of Stream Processing: Application Design, Systems, and Analytics", Cambridge University Press, 2014. |
| 2. | Bryon Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, 1st edition, 2014 |
| 3. | ub.com/stream-processing-with-spark |
| 4. | w.edx.org/course/processing-real-time-data-streams-in-azure |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No of Hours |
|---|---|---|
| **1** | **Introduction To Stream Processing Model** | |
| 1.1 | Fundamentals of Stream Processing | 1 |
| 1.2 | What Is Stream Processing | 1 |
| 1.3 | Examples of Stream Processing | 1 |
| 1.4 | Scaling Up Data Processing | 1 |
| 1.5 | Distributed Stream Processing | 1 |
| 1.6 | Introducing Apache Spark. Stream | 1 |
| 1.7 | Processing Model: Sources and Sinks | 1 |
| 1.8 | Immutable Streams Defined from One Another Transformations and Aggregations | 1 |
| 1.9 | Window Aggregations - Stateless and Stateful Processing- The Effect of Time. | 1 |
| **2** | **Streaming Architectures** | |
| 2.1 | Components of a Data Platform- Architectural Models | 1 |
| 2.2 | The Use of a Batch-Processing Component in a Streaming Application | 1 |
| 2.3 | Referential Streaming Architectures | 1 |
| 2.4 | Streaming Versus Batch Algorithms | 1 |
| 2.5 | Apache Spark as a Stream | 1 |
| 2.6 | Processing Engine: Spark's Memory Usage | 1 |
| 2.7 | Understanding Latency | 1 |
| 2.8 | Throughput Oriented Processing | 1 |
| 2.9 | Fast Implementation of Data Analysis | 1 |
| **3** | **Distributed Processing And Resilience Model** | |
| 3.1 | Spark's Distributed Processing Model: Running Apache Spark with a Cluster Manager | 1 |
| 3.2 | Spark's Own Cluster Manager | 1 |
| 3.3 | Resilience and Fault Tolerance in a Distributed System | 1 |
| 3.4 | Data Delivery Semantics | 1 |
| 3.5 | Microbatching and One-Element-at-a-Time - Bringing Microbatch and One-Record-at a- Time Closer | 1 |
| 3.6 | Dynamic Batch Interval | 1 |
| 3.7 | Structured Streaming Processing Model | 1 |
| 3.8 | Spark's Resilience Model | 1 |
| 3.9 | Resilient Distributed Datasets in Spark | 1 |
| **4** | Spark Components | |
| 4.1 | Spark's Fault-Tolerance Guarantees. | 1 |
| 4.2 | **Structured Streaming** | 2 |
| 4.3 | Introducing Structured Streaming | 1 |
| 4.4 | The Structured Streaming Programming Model | 1 |
| 4.5 | Structured Streaming in Action | 1 |
| 4.6 | Structured Streaming Sources | 1 |
| 4.7 | Structured Streaming Sinks | 1 |
| 4.8 | Event Time | 1 |
| **4.9** | Based Stream Processing. | |
| **5** | **Spark Streaming** | 1 |
| 5.1 | Introducing Spark Streaming | 2 |
| 5.2 | The Spark Streaming Programming Model | 1 |
| 5.3 | The Spark Streaming Execution Model | 1 |

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| | | |
|---|---|---|
| 5.4 | Spark Streaming Sources | 2 |
| 5.5 | Spark Streaming Sinks | 2 |
| 5.6 | Time-Based Stream Processing | 1 |
| 5.7 | Working with Spark SQL – Checkpointing | 1 |
| 5.8 | Monitoring Spark Streaming | 1 |
| 5.9 | Performance Tuning | 1 |
| | **Total** | **45** |

**Course Designers**

1.Mr.K.Saravanan (saravanank@ksrct.ac.in)



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| 60 PDS E45 | Ethics for Data Science | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objective

- To understand the ethical implications and responsibilities in data-driven decision-making.
- To learn about privacy, security, and data protection laws and practices.
- To identify, assess, and mitigate bias in algorithms and machine learning models.
- To comprehend the need for transparency and accountability in AI and automation systems.
- To apply ethical principles in real-world data science projects and audits.

## Prerequisite

Basic knowledge of **Data Science** and **Machine Learning** concepts.

## Course Outcome

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Apply ethical frameworks to analyze and solve ethical dilemmas in data science. | Understand |
| CO2 | Implement privacy-preserving techniques and adhere to global data protection laws. | Understand |
| CO3 | Identify and mitigate bias in machine learning models for fair and just outcomes. | Understand |
| CO4 | Ensure transparency and accountability in AI systems for responsible decision-making. | Apply |
| CO5 | Conduct ethical audits and ensure continuous ethical monitoring of data science projects. | Apply |

## Mapping with Program Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 2 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 2 | 2 |
| 3-Strong;2-Medium;1-Some | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember(Re) | 30 | 20 | 40 |
| Understand(Un) | 30 | 20 | 40 |
| Apply(Ap) | - | 20 | 20 |
| Analyse(An) | - | - | - |
| Evaluate(Ev) | - | - | - |
| Create(Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS E45- Ethics for Data Science | | | | | | | | |
| PDS: M.TECH DATA SCIENCE | | | | | | | | |
| Semester | Hours/Week | | | Total Hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| **III** | **3** | **0** | **0** | **45** | **3** | **40** | **60** | **100** |

| | |
|---|---|
| **Introduction to Data Science Ethics**<br>Ethics in Data Science: Overview, importance, and challenges,Ethical Frameworks: Consequentialism, deontology, and virtue ethics, Principles of Responsible Data Usage: Transparency, fairness, and accountability,Case Studies: Real-world examples of ethical challenges in data science. | [9] |
| **Privacy and Data Protection**<br>Data Privacy Concepts: Personal data, sensitive data, and privacy concerns,Privacy Models: k-Anonymity, differential privacy, and data minimization,Global Privacy Regulations: GDPR, HIPAA, and other data protection laws,Ethical Issues in Data Storage and Sharing: Responsibilities and consequences. | [9] |
| **Fairness, Bias, and Discrimination in Data**<br>Algorithmic Bias: Types of bias in data and machine learning models,Fairness in Machine Learning: Metrics such as equalized odds and demographic parity,Mitigating Bias: Techniques to identify and reduce bias in datasets and algorithms,Ethical Issues in Predictive Analytics: Impact on different social groups and communities | [9] |
| **Accountability and Transparency in AI Systems**<br>Accountability in AI and Data Science Projects: Ethical responsibility in development and deployment,The Black Box Problem: Challenges in understanding complex AI models, Explainability and Interpretability of AI: Techniques and importance of model transparency,Ethical Governance of AI: Standards, audits, and regulations for ethical AI use. | [9] |
| **Ethical Data Science in Practice**<br>Ethical Data Collection: Informed consent, data ownership, and rights,Social Implications of Data Science: Impact of data science on society, Data Science for Social Good: Projects and initiatives for positive societal impact, Ethical Audits and Continuous Monitoring: Procedures for ensuring ethical compliance in data science projects,Role of Ethics Committees: Review and oversight of ethical concerns in data science. | [9] |
| **Total Hours** | 45 |

**Text Books:**

| | |
|---|---|
| 1. | C. Dwork, A. Roth, "The Algorithmic Foundations of Differential Privacy," Foundations and Trends in Theoretical Computer Science, 2014. |
| 2. | Luciano Floridi, "The Ethics of Information," Oxford University Press, 2013. |

**Reference(s):**

| | |
|---|---|
| 1. | Cathy O'Neil, "Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy," Crown Publishing Group, 2016. |
| 2. | Virginia Eubanks, "Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor," St. Martin's Press, 2018. |
| 3. | Solon Barocas, Moritz Hardt, Arvind Narayanan, "Fairness and Machine Learning," 2019. |



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| 60 PDS E51 | Predictive Analytics for Internet of Things | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objectives**

- To explain terminology, technology and applications of predictive analysis.
- To apply data preparation techniques and generate appropriate association rules.
- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.

**Prerequisite**

Basic knowledge of Internet of Things, Data Mining, Machine Learning.

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explain terminology, technology and applications of predictive analysis | Analyse |
| CO2 | Apply data preparation techniques to effectively interpret big data. | Apply |
| CO3 | Explain the concept of IoT. | Understand |
| CO4 | Analyse various protocols for IoT. | Analyse |
| CO5 | Design a PoC of an IoT system using Rasperry Pi/Arduino. | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 2 | 2 | 2 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 2 | 3 |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 10 | 10 | 20 |
| Understand (Un) | 10 | 10 | 20 |
| Apply (Ap) | 20 | 20 | 30 |
| Analyse (An) | 20 | 20 | 30 |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS E51- Predictive Analytics for Internet of Things | | | | | | | | |
| PDS: M.TECH DATA SCIENCE | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction To Predictive Analytics**<br>Overview of Predictive Analytics- Setting Up the Problem - Data Understanding- Single Variable- Data Visualization in One Dimension- Data Visualization, Two or Higher Dimensions The Value of Statistical Significance- Pulling It All Together into a Data Audit. | **[9]** |
| **Data Preparation and Association Rules**<br>Data Preparation- Variable Cleaning- Feature Creation- Item sets and Association Rules-Terminology-Parameter Settings- How the Data Is Organized- Measures of Interesting Rules-Deploying Association Rules- Problems with Association Rules- Building Classification Rules from Association Rules. | **[9]** |
| **Fundamentals of Iot**<br>Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects | **[9]** |
| **Iot Protocols**<br>IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT | **[9]** |
| **Design And Development**<br>Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming. | **[9]** |
| **Total Hours** | **45** |

**Text book(s):**


1. Dean Abbott, ‘Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst’, Wiley, 2014
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ‘IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things’, Cisco Press, 2017


**Reference(s):**


1. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2. Conrad Carlberg, ‘Predictive Analytics: Microsoft Excel, 1st Edition, Que Publishing, 2012.
3. ArshdeepBahga, Vijay Madisetti, ‘Internet of Things – A hands-on approach’, Universities Press, 2015
4. Olivier Hersent, David Boswarthick, Omar Elloumi, ‘The Internet of Things – Key applications and Protocols’, Wiley, 2012.




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## Course Contents and Lecture Schedule

| S.No. | Topic | No. of Hours |
|---|---|---|
| **1.0** | **Introduction To Predictive Analytics** | |
| 1.1 | Overview of Predictive Analytics | 1 |
| 1.2 | Setting Up the Problem | 1 |
| 1.3 | Data Understanding | 2 |
| 1.4 | Single Variable | 1 |
| 1.5 | Data Visualization in One Dimension | 1 |
| 1.6 | Data Visualization, Two or Higher Dimensions | 1 |
| 1.7 | The Value of Statistical Significance | 1 |
| 1.8 | Pulling It All Together into a Data Audit | 1 |
| **2.0** | **Data Preparation and Association Rules** | |
| 2.1 | Data Preparation | 1 |
| 2.2 | Variable Cleaning-Feature Creation | 1 |
| 2.3 | Item sets and Association Rules | 1 |
| 2.4 | Terminology- Parameter Settings | 1 |
| 2.5 | How the Data Is Organized- Measures of Interesting Rules | 1 |
| 2.6 | Deploying Association Rules | 1 |
| 2.7 | Problems with Association Rules | 1 |
| 2.8 | Building Classification Rules from Association Rules | 2 |
| **3.0** | **Fundamentals Of Iot** | |
| 3.1 | Evolution of Internet of Things- Enabling Technologies | 1 |
| 3.2 | IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models | 1 |
| 3.3 | Simplified IoT Architecture and Core IoT Functional Stack | 2 |
| 3.4 | Fog, Edge and Cloud in IoT | 2 |
| 3.5 | Functional blocks of an IoT ecosystem | 2 |
| 3.6 | Sensors, Actuators, Smart Objects and Connecting Smart Objects | 1 |
| **4.0** | **Iot Protocols** | |
| 4.1 | IoT Access Technologies: Physical and MAC layers | 1 |
| 4.2 | topology and Security of IEEE 802.15.4 | 1 |
| 4.3 | 802.15.4g, 802.15.4e | 1 |
| 4.4 | 1901.2a, 802.11ah and LoRaWAN | 1 |
| 4.5 | Network Layer: IP versions, Constrained Nodes and Constrained Networks | 1 |
| 4.6 | Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks | 1 |
| 4.7 | Application Transport Methods: Supervisory Control and Data Acquisition | 1 |
| 4.8 | Application Layer Protocols: CoAP and MQTT | 2 |
| **5.0** | **Design And Development** | |
| 5.1 | Design Methodology | 1 |
| 5.2 | Embedded computing logic | 2 |
| 5.3 | Microcontroller, System on Chips | 1 |
| 5.4 | IoT system building blocks | 1 |
| 5.5 | Arduino | 1 |
| 5.6 | Board details, IDE programming | 1 |
| 5.7 | Raspberry Pi | 1 |
| 5.8 | Interfaces and Raspberry Pi with Python Programming | 1 |
| | **Total** | **45** |

## Course Designers

Gayathri.S, AP/IT.

Rev. No.3/w.e.f. 22.07.2024 Approved Passed in BoS Meeting held on 24/05/2024in Academic Council Meeting held on 25/05/2024

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| 60 PDS E52 | Data Governance And Quality | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objectives**

- To define basic concepts of kernal in Machine Learning
- To recognize different methods of using kernal
- To use different types of Datasets for solving different problems.
- To examine different supervised learning using kernals
- To compare the usage of different unsupervised learning for continuous data.

**Prerequisite**

Basic knowledge of Higher Secondary Mathematics& Machine Learning.

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Understand the need for machine learning for solving problem | Understand |
| CO2 | Recognize the basic patterns of data and choose right machine learning model. | Remember |
| CO3 | Apply the apt linear model for solving non linear problem. | Apply |
| CO4 | Implement Supervised learning for solving machine learning problems using kernal. | Apply |
| CO5 | Demonstrate the usage of Unsupervised learning for different types of Datasets. | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO4 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO5 | 2 | 3 | 3 | 3 | 2 | 2 |
| 3-Strong;2-Medium;1-Some | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 30 | 20 | 20 |
| Understand (Un) | 30 | 20 | 30 |
| Apply (Ap) | - | 20 | 30 |
| Analyse (An) | - | - | 20 |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS E52 Data Governance and Quality | | | | | | | | |
| PDS: M.TECH DATA SCIENCE | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction:**<br>Basics of Machine Learning – Kernal – Methods – Kernal Methods in Machine Learning – Applications of Kernal Methods – Kernal methods and neural networks – Non linear model – Linear Model – Simple kernel examples | **[9]** |
| **Kernels and Reproducing Kernel Hilbert Spaces (RKHS)**<br>Positive definiteness kernal - Reproducing Kernel Hilbert Spaces - Aronszjan theorem - Regularizing with RKHS norms - The kernel trick - string kernels - shift-invariant kernels.- Mercer kernels, large-scale kernel learning, | **[9]** |
| **Methods of Kernel**<br>Principle Component Analysis - Support Vector Machine - Gaussian Process - Canonical Correlation Analysis - Spectral Clustering - Adaptive Filter - Kernel Perceptron - Monolithic Kernel | **[9]** |
| **Supervised learning with kernels**<br>The representer theorem - Kernel ridge regression - Empirical risk minimization - A tiny bit of learning theory - Focus on support vector machines - Kernels for generative models - Kernels for graphs - Kernels on graphs | **[9]** |
| **Unsupervised learning with kernels**<br>Kernel K-means - spectral clustering - Mercer kernels - shift-invariant kernels - Kernels for generative models - Multiple kernel learning - shift-invariant kernels - deep kernel learning. | **[9]** |
| **Total Hours** | **45** |

**Textbook(s):**


1. N. Cristianini and J. Shawe-Taylor, 'Kernel Methods for Pattern Analysis', Cambridge University Press, 2004.
2. B. Scholkopf et A. Smola, 'Learning with kernels', MIT Press, 2002.


**Reference(s):**


1. N. Aronszajn, 'Theory of reproducing kernels', Transactions of the American Mathematical Society, 68:337-404, 1950.
2. V. Vapnik, 'Statistical Learning Theory', Wiley, 1998.
3. C. Berg, J.P.R. Christensen et P. Ressel, 'Harmonic analysis on semi-groups', Springer, 1994.
4. B. Scholkopf, K. Tsuda et J.-P. Vert, 'Kernel methods in computational biology', MIT Press, 2004.




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## Course Contents and Lecture Schedule

| S.No. | Topic | No. of Hours |
|---|---|---|
| **1.0** | **Introduction** | |
| 1.1 | Basics of Machine Learning | 1 |
| 1.2 | Kernal | 1 |
| 1.3 | Methods | 1 |
| 1.4 | Kernal Methods in Machine Learning | 1 |
| 1.5 | Applications of Kernal Methods | 1 |
| 1.6 | Kernal methods and neural networks | 1 |
| 1.7 | Non linear model | 1 |
| 1.8 | Linear Model | 1 |
| 1.9 | Simple kernel examples | 1 |
| **2.0** | **Kernels and Reproducing Kernel Hilbert Spaces (RKHS)** | |
| 2.1 | Positive definiteness kernal | 1 |
| 2.2 | Reproducing Kernel Hilbert Spaces | 1 |
| 2.3 | Aronszjan theorem | 1 |
| 2.4 | Regularizing with RKHS norms | 1 |
| 2.5 | The kernel trick | 1 |
| 2.6 | String kernels | 1 |
| 2.7 | Shift-invariant kernels | 1 |
| 2.8 | Mercer kernels | 1 |
| 2.9 | Large-scale kernel learning | 1 |
| **3.0** | **Methods of Kernel** | |
| 3.1 | Principle Component Analysis | 1 |
| 3.2 | Support Vector Machine | 1 |
| 3.3 | Gaussian Process | 1 |
| 3.4 | Canonical Correlation Analysis | 1 |
| 3.5 | Spectral Clustering | 1 |
| 3.6 | Adaptive Filter | 2 |
| 3.7 | Kernel Perceptron | 1 |
| 3.8 | Monolithic Kernel | 1 |
| **4.0** | **Supervised learning with kernels** | |
| 4.1 | The representer theorem | 1 |
| 4.2 | Kernel ridge regression | 1 |
| 4.3 | Empirical risk minimization | 2 |
| 4.4 | A tiny bit of learning theory | 1 |
| 4.5 | Focus on support vector machines | 1 |
| 4.6 | Kernels for generative models | 1 |
| 4.7 | Kernels for graphs | 1 |
| 4.8 | Kernels on graphs | 1 |
| **5.0** | **Unsupervised learning with kernels** | |
| 5.1 | Kernel K-means | 1 |
| 5.2 | Spectral clustering | 1 |
| 5.3 | Mercer kernels | 1 |
| 5.4 | Shift-invariant kernels | 1 |
| 5.5 | Kernels for generative models | 1 |
| 5.6 | Multiple kernel learning | 2 |
| 5.7 | Shift-invariant kernels | 1 |
| 5.8 | Deep kernel learning | 1 |
| | **Total** | **45** |

## Course Designers

1.K Senthil Kumar – senthilkumark@ksrct.ac.in

Rev. No.3/w.e.f. 22.07.2024 Approved Passed in BoS Meeting held on 24/05/2024in Academic Council Meeting held on 25/05/2024

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| 60 PDS E53 | Web Analytics and Development | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

**Objectives**

- Enable the students to learn basic web concepts
- To apply the features of XML and JDBC Connectivity
- To Write scripts in PERL and JSP
- Know the concept of Java web framework
- Be familiar with Web framework

**Prerequisite**

Basic Web Concepts, XML and JDBC connectivity, PERL and JSP.web Framework

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Express the features of HTML and Employ various style sheet concepts in HTML | Analyse |
| CO2 | Analysing the concepts of XML and JDBC | Analyse |
| CO3 | Describe the purpose of PERL language and Gain the knowledge of JSP in server side programming | Understand |
| CO4 | Use the concept of Java web framework | Apply |
| CO5 | Critically analyze the various Web frameworks | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO4 | 2 | 3 | 3 | 3 | 2 | 2 |
| CO5 | 2 | 3 | 3 | 3 | 2 | 2 |
| 3-Strong;2-Medium;1-Some | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 10 | 10 | 10 |
| Understand (Un) | 20 | 20 | 40 |
| Apply (Ap) | 20 | 30 | 20 |
| Analyse (An) | 10 | - | 30 |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| 60 PDS E53 - Web Analytics and Development | | | | | | | | |
| PDS: M.TECH DATA SCIENCE | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | MaximumMarks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction Internet Basic** - Introduction to HTML - List - Creating Table - Linking document - Frames - Graphics to HTML Doc - Style sheet - Style sheet basic - Add style to document - Creating Style sheet rules - Style sheet properties - Font - Text - List - Color and background color - Box - Display properties. | **[9]** |
| **XML AND JDBC -** Features of XML, The XML Declaration, Element Tags- Nesting and structure, XML text and text formatting element, Table element, Mark-up Element and Attributes, Document Type Definition (DTD),.XML Schema-Introduction-Jdbc Architecture-Types of Drivers-Statement-Result Set Prepared Statement-Connection Modes-Save Point-Batch Updations- Callable Statement | **[9]** |
| **PERL AND JSP** Programming CGI Scripts – PERL-Introduction-Jsp Life Cycle-Jsp Implicit Objects & Scopes Jsp Directives:page ,include, taglib-Jsp Scripting Elements declaratives, scriptlets, Expressions Jsp Actions- Standard Action ,Custom Actions-Data Baese Connectivity in JSP | **[9]** |
| **Struts**<br>Struts and Agile Development -Basic Configuration.-Actions and Action Support.-Results and Result Types.-OGNL, the Value Stack, and Custom Tags-Form Tags- Form Validation and Type Conversion Exceptions and Logging-Getting Started with JavaScript-Advanced JavaScript, the DOM, and CSS Themes and Templates-Rich Internet Applications. | **[9]** |
| **Turbogears Web Framework**<br>Introduction to Turbo Gears-Turbo Gears History-Main Turbo Gears Components-Alternate Components-MVC Architecture in TurboGears-Creating an Example Application-The Controller and View-Introduction to Django-Django History-Django Components-Alternate Components-MVC Architecture in Django-Creating an Example Application | **[9]** |
| **Total Hours** | **45** |

**Textbook(s):**

| | |
|---|---|
| 1. | Haggit Attiya and Jennifer Welch, Distributed Computing – Fundamentals, Simulations and Advanced Topicsǁ, Second Edition, Wiley, 2012. |
| 2. | Donald Brown, Chad Michael Davis, Scott Stanlick ,Struts 2 In Action Dream tech press 2008 |

Reference(s):

| | |
|---|---|
| 1. | Eric Ladd and Jim O'Donnell, et al, "USING HTML 4, XML, and JAVA1.2", PHI publications, 2003. |
| 2. | N. P. Gopalan," Web Technology: A Developer's Perspective", Second edition PHI Learning 2014 |
| 3. | Adrian Holovaty Jacob Kaplan-Moss, The Definitive Guide to Django: Web Development Done Right, Apress, 2009 |
| 4. | Mark Ramm, Rapid Web applications with Turbo Gears, Prentice Hall.2009 |

## Course Contents and Lecture Schedule

| S.No. | Topic | No. of Hours |
|---|---|---|
| **1.0** | **Introduction Internet Basic** | |
| 1.1 | Introduction to HTML, List, Creating Table | 1 |
| 1.2 | Linking document, - Frames, Graphics to HTML Doc | 2 |
| 1.3 | Style sheet, Style sheet basic, Add style to document | 2 |
| 1.4 | Creating Style sheet rules, | 1 |
| 1.5 | Style sheet properties, Font, Text, List | 1 |
| 1.6 | Color and background color | 1 |
| 1.7 | Box, Display properties | 1 |
| **2.0** | **Xml And Jdbc** | |
| 2.1 | Features of XML, The XML Declaration | 1 |
| 2.2 | Element Tags, Nesting and structure | 1 |
| 2.3 | XML text and text formatting element | 1 |
| 2.4 | Table element, Mark-up Element and Attributes | 1 |
| 2.5 | Document Type Definition (DTD), XML Schema, | 1 |
| 2.6 | Introduction Jdbc Architecture, | 1 |
| 2.7 | Types of Drivers, Statement-ResultSetPreparedStatement | 1 |
| 2.8 | Connection Modes, SavePoint,Batch Updations.CallableStatement | 2 |
| **3.0** | **PERL AND JSP** | |
| 3.1 | Programming CGI Scripts, PERL, Introduction, JspLifeCycle | 2 |
| 3.2 | Jsp Implicit Objects & ScopesJspDirectives:page | 1 |
| 3.3 | Include,taglib, Jsp Scripting Elements declaratives, | 2 |
| 3.4 | Scriptlets, expressionsJspActions | 1 |
| 3.5 | StandardAction, Custom Actions | 1 |
| 3.6 | DataBaese Connectivity in JSP | 2 |
| **4.0** | **STRUTS** | |
| 4.1 | Struts and Agile Development, Basic Configuration | 2 |
| 4.2 | Actions and Action Support, Results and Result Types | 1 |
| 4.3 | OGNL, the Value Stack and Custom Tags | 1 |
| 4.4 | Form Tags, Form Validation and Type Conversion Exceptions and Logging | 2 |
| 4.5 | Getting Started with JavaScript, Advanced JavaScript | 1 |
| 4.6 | The DOM, and CSSThemes and Templates, | 1 |
| 4.7 | Rich Internet Applications | 1 |
| **5.0** | **Turbogears Web Framework** | |
| 5.1 | Introduction to TurboGears,TurboGears History | 1 |
| 5.2 | Main TurboGears Components,Alternate Components | 2 |
| 5.3 | MVC Architecture in TurboGears,Creating an Example Application | 2 |
| 5.4 | The Controller and View,Introduction to Django | 1 |
| 5.5 | Django History,Django Components,Alternate Components | 1 |
| 5.6 | MVC Architecture in Django | 1 |
| 5.7 | Creating an Example Application | 1 |
| | **Total** | **45** |

## Course Designers

1. Mr.S.Arulmurugan – arulmurgans@ksrct.ac.in



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| 60 PDS E54 | Next Generation Databases | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objective

- To review the database revolutions and data storage techniques
- To understand NoSQL and document databases
- To understand column databases and In memory databases
- To understand distributed database patterns and consistency models
- To study database models, storage and disruptive database technologies

## Prerequisite

Basic knowledge of Database Technologies and Data Models

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explore the differences between Relational and NoSQL databases. | Understand |
| CO2 | Analyse NoSQL databases to Store the big data for useful business applications. | Analyse |
| CO3 | Apply the different data models to suit various data representation and storage needs. | Apply |
| CO4 | Design distributed databases. | Apply |
| CO5 | Implement graph data bases like NEO4J and other trending technologies | Apply |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO5 | 2 | 2 | 3 | 3 | 2 | 2 |
| 3-Strong;2-Medium;1-Some | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 20 | 20 | 20 |
| Understand (Un) | 20 | 20 | 30 |
| Apply (Ap) | 10 | 20 | 30 |
| Analyse (An) | 10 | - | 20 |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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|---|---|---|---|---|---|---|---|---|
| **60 PDS E54 – NEXT GENERATION DATABASES** | | | | | | | | |
| **PDS: M.TECH DATA SCIENCE** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

**Database Revolutions**

Database Revolutions: System Architecture- Relational Database- Database Design-Data Storage Transaction Management- Data warehouse and Data Mining- Information Retrieval. [9]

**Document Databases**

Big Data Revolution: CAP Theorem- Birth of NoSQL- Document Database — XML Databases JSON Document Databases- Graph Databases. [9]

**Column and Memory Databases**

Column Databases: Data Warehousing Schemes- Columnar Alternative- Sybase IQ- C Store and Vertica- Column Database Architectures- SSD and In-Memory Databases— In-Memory Databases- Berkeley Analytics Data Stack and Spark. [9]

**Distributed Database Patterns**

Distributed Database Patterns: Distributed Relational Databases- Non-relational Distributed Databases- MongoDB - Sharing and Replication- HBase- Cassandra-Consistency Models Types of Consistency- Consistency MongoDB- HBase Consistency- Cassandra Consistency. [9]

**Data Models and Storage**

Data Models and Storage: SQL- NoSQL APIs- Return SQL- Advance Databases- Postgre SQL Riak- CouchDB- NEO4J - Redis- Future Databases - Revolution Revisited-Counter revolutionaries Oracle HQ Other Convergent Databases- Disruptive Database Technologies. [9]

| | |
|---|---|
| **Total Hours** | **45** |

**Text book(s)**

| | |
|---|---|
| 1. | Guy Harrison, 'Next Generation Databases – NoSQL, NewSQL and Big Data', Apress, 2018. |
| 2. | Abraham Silberschatz,Henry F. Korth, S.Sudarshan, 'Database System Concepts', McGraw Hill, Seventh Edition, 2017 |

**Reference(s):**

| | |
|---|---|
| 1. | Alain Issa & Francis Schieldz, 'Couch,DB Document oriented databases' ,ULB, 2017 |
| 2. | Eric Redmond, Jim R, Wilson 'Seven Databases in Seven Weeks', O'Reilly, Second Edition, 2018 |
| 3. | Dan Sullivan, 'NoSQL for Mere Mortals', Addison-Wesley, O'Reilly, Second Edition, 2015. |
| 4. | Adam Fowler, 'NoSQL for Dummies', John Wiley & Sons, Second Edition, 2015. |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Database Revolutions** | |
| 1.1 | Database Revolutions | 1 |
| 1.2 | System Architecture | 1 |
| 1.3 | Relational Database | 1 |
| 1.4 | Database Design | 1 |
| 1.5 | Data Storage | 1 |
| 1.6 | Transaction Management | 1 |
| 1.7 | Data warehouse | 1 |
| 1.8 | Data Mining | 1 |
| 1.9 | Information Retrieval | 1 |
| **2** | **Document Databases** | |
| 2.1 | Big Data Revolution | 1 |
| 2.2 | CAP Theorem | 1 |
| 2.3 | Birth of NoSQL | 1 |
| 2.4 | Document Database | 1 |
| 2.5 | XML Databases | 2 |
| 2.6 | JSON Document Databases | 2 |
| 2.7 | Graph Databases | 1 |
| **3** | **Hough Transform** | |
| 3.1 | Column Databases | 1 |
| 3.2 | Data Warehousing Schemes | 1 |
| 3.3 | Columnar Alternative | 1 |
| 3.4 | Sybase IQ | 1 |
| 3.5 | Store and Vertica | 1 |
| 3.6 | Column Database Architectures- SSD | 1 |
| 3.7 | In-Memory Databases | 1 |
| 3.8 | Berkeley Analytics | 1 |
| 3.9 | Data Stack and Spark | 1 |
| **4** | **Column and Memory Databases** | |
| 4.1 | Distributed Database Patterns | 1 |
| 4.2 | Distributed Relational Databases | 1 |
| 4.3 | Non-relational Distributed Databases | 1 |
| 4.4 | MongoDB - Sharing and Replication | 1 |
| 4.5 | HBase- Cassandra | 1 |
| 4.6 | Consistency Models Types of Consistency | 1 |
| 4.7 | Consistency MongoDB | 1 |
| 4.8 | HBase Consistency | 1 |



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| | | |
|---|---|---|
| 4.9 | Cassandra Consistency | 1 |
| **5** | **Data Models and Storage** | |
| 5.1 | Data Models and Storage | 1 |
| 5.2 | SQL- NoSQL APIs | 1 |
| 5.3 | Return SQL- Advance Databases | 1 |
| 5.4 | Postgre SQL Riak | 1 |
| 5.5 | CouchDB- NEO4J | 1 |
| 5.6 | Redis- Future Databases | 1 |
| 5.7 | Revolution Revisited & Counter revolutionaries | 1 |
| 5.8 | Oracle HQ and Other Convergent Databases | 1 |
| 5.9 | Disruptive Database Technologies | 1 |
| | **Total** | **45** |

## Course Designers

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| | | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 60 PDS E55 | GPU Computing | PE | 3 | 0 | 0 | 3 |

**Ojectives**

- To understand the GPU Architecture and terminology used in GPU computing
- To learn memory allocation techniques and programming models
- To explore the knowledge on synchronization and memory consistency
- To develop aparallel algorithm for debugging GPU Programs
- To analyse an algorithm to provide parallel solutions to computationally challenging problems.

**Prerequisite**

Operating System

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Describe GPU architectures and terminology used in GPU computing | Understand |
| CO2 | Analyse the programming models for memory allocation in GPU Computing | Analyse |
| CO3 | Implement the programs for concept of synchronization and data structure | Apply |
| CO4 | Develop an efficient parallel algorithm for debugging GPU Programs | Apply |
| CO5 | Apply algorithms to provide parallel solutions to computationally challenging problems | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | 2 |
| 3-Strong; 2-Medium; 1-Some | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 20 | 20 | 20 |
| Understand (Un) | 20 | 20 | 30 |
| Apply (Ap) | 10 | 20 | 30 |
| Analyse (An) | 10 | - | 20 |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PDS E55-GPU Computing** | | | | | | | | |
| **PDS: M.TECH DATA SCIENCE** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction:** History, GPU Architecture, Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel Programming, CUDA OpenCL / Open ACC, Kernels, Launch parameters, Thread hierarchy, Warps/Wave fronts, Thread blocks/Workgroups, Streaming multiprocessors, 1D/2D/3D thread mapping, Device properties, Simple Programs. | **[9]** |
| **Memory:** Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories | **[9]** |
| **Synchronization:** Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Work lists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions | **[9]** |
| **Support:** Debugging GPU Programs. Profiling, Profile tools, Performance aspects Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls. | **[9]** |
| **Advanced Topics:** Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing. Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning. | **[9]** |
| **Total Hours** | **45** |

| | |
|---|---|
| **Text book(s):** | |
| 1. | Benedict R Gaster, Lee Howes, David, R. Kaeli, Perhaad Mistry and Dana Schaa, 'Heterogeneous Computing with Open CL', Elsevier, 2013. |
| 2. | David Kirk, Wen-mei Hwu, Morgan Kaufman, 'Programming Massively Parallel Processors: A Hands-on Approach',2010 (ISBN: 978-0123814722) |
| **Reference(s):** | |
| 1. | Shane Cook, Morgan Kaufman,CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, 2012 |
| 2. | Aaftab Munshi, Benedict Gaster, Timothy G. Mattson, James Fung & Dan Ginsburg, 'OpenCL Programming Guide', Addison-Wesley Professional, 2011. |
| 3. | RyojiTsuchiyama, Takashi Nakamura, TakuroIizuka & Akihiro Asahara, 'The OpenCL Programming Book', Fixstars Corporation, 2010. |
| 4. | Matthew Scarpio, 'OpenCL in Action: How to Accelerate Graphics and Computations', Manning Publications, 2011. |



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## Course Contents and Lecture Schedule

| S.No. | Topic | No. of Hours |
|---|---|---|
| **1.0** | **Introduction: History** | |
| 1.1 | GPU Architecture | 1 |
| 1.2 | Clock speeds | 1 |
| 1.3 | CPU / GPU comparisons | 1 |
| 1.4 | Heterogeneity, Accelerators | 1 |
| 1.5 | Parallel Programming, CUDA OpenCL / OpenACC | 1 |
| 1.6 | Kernels, Launch parameters | 1 |
| 1.7 | Thread hierarchy, Warps/Wavefronts | 1 |
| 1.8 | Threadblocks/Workgroups, Streaming multiprocessors | 1 |
| 1.9 | 1D/2D/3D thread mapping, Device properties, Simple Programs | 1 |
| 2.0 | **Memory** | |
| 2.1 | Memory hierarchy | 1 |
| 2.2 | DRAM / global, local / shared, private / local | 1 |
| 2.3 | textures, Constant Memory | 1 |
| 2.4 | Pointers, Parameter Passing | 1 |
| 2.5 | Arrays and dynamic Memory | 1 |
| 2.6 | Multi-dimensional Arrays, Memory Allocation | 1 |
| 2.7 | Memory copying across devices | 1 |
| 2.8 | Programs with matrices | 1 |
| 2.9 | Performance evaluation with different memories | 1 |
| **3.0** | **Synchronization** | |
| 3.1 | Memory Consistency, | 1 |
| 3.2 | Barriers (local versus global) | 1 |
| 3.3 | Atomics, Memory fence | 1 |
| 3.4 | Prefix sum, Reduction | 1 |
| 3.5 | Programs for concurrent Data Structures such as Worklists, Linked-lists | 1 |
| 3.6 | Synchronization across CPU | 1 |
| 3.7 | GPU Functions: Device functions, Host functions, Kernels functions | 1 |
| 3.8 | Using libraries (such as Thrust) | 1 |
| 3.9 | developing libraries | |
| **4.0** | **Support** | |
| 4.1 | Debugging GPU Programs | 1 |
| 4.2 | Profiling, Profile tools | 1 |
| 4.3 | Performance aspects Streams | 1 |
| 4.4 | Asynchronous processing | 1 |
| 4.5 | tasks, Task-dependence | 1 |
| 4.6 | Overlapped data transfers | 1 |
| 4.7 | Default Stream, Synchronization with streams | 1 |
| 4.8 | Events, Event-based- Synchronization | 1 |
| 4.9 | Overlapping data transfer and kernel execution, pitfalls | 1 |
| **5.0** | **Design of RTS- General Introduction** | |
| 5.1 | Dynamic parallelism | 1 |
| 5.2 | Unified Virtual Memory | 1 |
| 5.3 | Multi-GPU processing | 1 |
| 5.4 | Peer access, Heterogeneous processing | 1 |
| 5.6 | Image Processing | 1 |
| 5.7 | Graph algorithms | 1 |
| 5.8 | Simulations | 1 |
| 5.9 | Deep Learning | 1 |
| | **Total** | **45** |

## Course Designers

1. Dr.K.Prasanth – prasanth@ksrct.ac.in

Rev. No.3/w.e.f. 22.07.2024 Approved Passed in BoS Meeting held on 24/05/2024in Academic Council Meeting held on 25/05/2024

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| 60 PDS E61 | Computer Vision | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

## Objective

- To review image processing techniques for computer vision
- To understand shape and region analysis
- To understand Hough Transform and its applications to detect lines, circles, ellipses
- To understand three-dimensional image analysis techniques
- To study some applications of computer vision algorithms

## Prerequisite

Basic knowledge of Probability & Statistics, Linear Algebra and Image Processing

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Implement fundamental image processing techniques required for computer vision | Understand |
| CO2 | Perform shape analysis and implement boundary tracking techniques | Analyse |
| CO3 | Apply Hough Transform for line, circle, and ellipse detections | Apply |
| CO4 | Apply 3D vision techniques and implement motion related techniques | Apply |
| CO5 | Develop applications using computer vision techniques | Apply |

## Mapping with Programme Outcomes

| COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO2 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO5 | 2 | 2 | 3 | 3 | 2 | 2 |
| 3-Strong;2-Medium;1-Some | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 20 | 20 | 20 |
| Understand (Un) | 20 | 20 | 30 |
| Apply (Ap) | 10 | 20 | 30 |
| Analyse (An) | 10 | - | 20 |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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| K.S.Rangasamy College of Technology – Autonomous R2022 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PDS E61 - COMPUTER VISION** | | | | | | | | |
| **PDS: M.TECH DATA SCIENCE** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |
| **Objective(s)** | • To review image processing techniques for computer vision<br>• To understand shape and region analysis<br>• To understand Hough Transform and its applications to detect lines, circles, ellipses<br>• To understand three-dimensional image analysis techniques<br>• To study some applications of computer vision algorithms | | | | | | | |
| **Course Outcomes** | **At the end of the course, the students will be able to**<br>CO1: Implement fundamental image processing techniques required for computer vision<br>CO2: Perform shape analysis and implement boundary tracking techniques<br>CO3: Apply Hough Transform for line, circle, and ellipse detections<br>CO4: Apply 3D vision techniques and implement motion related techniques<br>CO5: Develop applications using computer vision techniques | | | | | | | |

**Note:** The hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Image Processing Foundations**<br>Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture | [9] |
| **Shapes and Regions**<br>Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments | [9] |
| **Hough Transform**<br>Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation | [9] |
| **3D Vision and Motion**<br>Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion | [9] |
| **Applications**<br>Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – | [9] |



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| | | |
|---|---|---|
| Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians | | |
| | **Total Hours** | **45** |
| **Text book(s)** | | |
| 1. | D. L. Baggio et al., 'Mastering Open CV with Practical Computer Vision Projects', Packt Publishing, 2012 | |
| 2. | E. R. Davies, 'Computer & Machine Vision', Fourth Edition, Academic Press, 2012. | |
| **Reference(s):** | | |
| 1. | Jan Erik Solem, 'Programming Computer Vision with Python: Tools and algorithms for analyzing images', O'Reilly Media, 2012. | |
| 2. | Mark Nixon and Alberto S. Aquado, 'Feature Extraction & Image Processing for Computer Vision', 3rd Edition, Academic Press, 2012. | |
| 3. | R. Szeliski, 'Computer Vision: Algorithms and Applications', Springer 2011. | |
| 4. | Simon J. D. Prince, 'Computer Vision: Models, Learning, and Inference', Cambridge University Press, 2012. | |



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Course Contents and Lecture Schedule

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Image Processing Foundations** | |
| 1.1 | Review of image processing techniques | 1 |
| 1.2 | Classical Filtering Operations | 2 |
| 1.3 | Thresholding Techniques | 1 |
| 1.4 | Edge Detection Techniques | 1 |
| 1.5 | Corner And Interest Point Detection | 1 |
| 1.6 | Mathematical Morphology | 2 |
| 1.7 | Texture | 1 |
| **2** | **Shapes and Regions** | |
| 2.1 | Binary Shape Analysis – Connectedness | 1 |
| 2.2 | Object Labeling And Counting | 1 |
| 2.3 | Size Filtering – Distance Functions | 1 |
| 2.4 | Skeletons And Thinning – Deformable Shape Analysis | 1 |
| 2.5 | Boundary Tracking Procedures – Active Contours | 1 |
| 2.6 | Shape Models And Shape Recognition – Centroidal Profiles | 1 |
| 2.7 | Handling Occlusion – Boundary Length Measures | 1 |
| 2.8 | Boundary Descriptors – Chain Codes | 1 |
| 2.9 | Fourier Descriptors – Region Descriptors – Moments | 1 |
| **3** | **Hough Transform** | |
| 3.1 | Line Detection – Hough Transform (HT) For Line Detection | 1 |
| 3.2 | Foot-Of-Normal Method – Line Localization – Line Fitting | 1 |
| 3.3 | RANSAC For Straight Line Detection – HT Based Circular Object Detection | 1 |
| 3.4 | Accurate Center Location – Speed Problem | 1 |
| 3.5 | Ellipse Detection – Case Study | 1 |
| 3.6 | Human Iris Location – Hole Detection | 1 |
| 3.7 | Generalized Hough Transform (GHT) – Spatial Matched Filtering | 1 |
| 3.8 | GHT For Ellipse Detection | 1 |
| 3.9 | Object Location – GHT For Feature Collation | 1 |
| **4** | **3D Vision and Motion** | |
| 4.1 | Methods For 3D Vision – Projection Schemes | 1 |
| 4.2 | Shape From Shading – Photometric Stereo | 1 |
| 4.3 | Shape From Texture – Shape From Focus | 1 |
| 4.4 | Active Range Finding – Surface Representations | 1 |
| 4.5 | Point-Based Representation – Volumetric Representations | 1 |
| 4.6 | 3D Object Recognition – 3D Reconstruction | 1 |
| 4.7 | Introduction To Motion – Triangulation | 1 |
| 4.8 | Bundle Adjustment – Translational Alignment – Parametric Motion | 1 |
| 4.9 | Spline-Based Motion – Optical Flow – Layered Motion | 1 |
| **5** | **Applications** | |
| 5.1 | Application: Photo Album – Face Detection | 1 |
| 5.2 | Face Recognition – Eigen Faces | 1 |
| 5.3 | Active Appearance And 3d Shape Models Of Faces Application | 1 |

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| | | |
|---|---|---|
| 5.4 | Surveillance – Foreground-Background Separation | 1 |
| 5.5 | Particle Filters – Chamfer Matching, Tracking, And Occlusion | 2 |
| 5.6 | Combining Views From Multiple Cameras | 1 |
| 5.7 | Human Gait Analysis Application | 1 |
| 5.8 | In-Vehicle Vision System: Locating Roadway – Road Markings | 1 |
| 5.9 | Identifying Road Signs – Locating Pedestrians | 1 |
| | **Total** | **45** |

## Course Designers

**1. Dr.K.Prasanth – prasanth@ksrct.ac.in**



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| 60 PDS E62 | Theoretical and Computational Neuroscience | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

## Objective

- To familiarize fundamentals of neuroscience
- To widen the knowledge about neural encoding and decoding process
- To learn the concept of neuro electronics and network models
- To develop the skills in various learning techniques of neuroscience
- To understand the model of computational neuroscience and neural networks

## Prerequisite

Basic knowledge of Neural Network and Machine Learning

## Course Outcomes

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Comprehend about neuroscience and nervous system | Understand |
| CO2 | Apply appropriate encoding and decoding techniques for neural system | Apply |
| CO3 | Classify the electrical properties of neuron with the aid of necessary network models | Analyse |
| CO4 | Differentiate a mixture of learning techniques | Apply |
| CO5 | Recognize the use of computational neuroscience with neural network concept | Analyse |

## Mapping with Programme Outcomes

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | 3 | 2 | - |
| CO2 | 2 | 2 | 3 | 3 | 2 | - |
| CO3 | 2 | 2 | 3 | 3 | 2 | - |
| CO4 | 2 | 2 | 3 | 3 | 2 | - |
| CO5 | 2 | 2 | 3 | 3 | 2 | - |
| 3-Strong;2-Medium;1-Some | | | | | | |

## Assessment Pattern

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 20 | 20 | 20 |
| Understand (Un) | 20 | 20 | 30 |
| Apply (Ap) | 20 | 10 | 30 |
| Analyze (An) | - | 10 | 20 |
| Evaluate(Ev) | - | - | - |
| Create (Cr) | - | - | - |



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**K.S.Rangasamy College of Technology – Autonomous R2022**

**60 PDS E62 - Theoretical and Computational Neuroscience**

**PDS: M.TECH DATA SCIENCE**

| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

**Note:** he hours given against each topic are of indicative. The faculty has the freedom to decide the hours required for each topic based on importance and depth of coverage required. The marks allotted for questions in the examinations shall not depend on the number of hours indicated.

| | |
|---|---|
| **Fundamentals of Neuro science**<br>Introduction, General Features and Cells of the Nervous System, Neural Signaling, Synaptic Transmission, Chemical Senses, The Auditory System, The Visual System, Cognition and Memory, Development of the Nervous System | [9] |
| **Neural Encoding and Decoding**<br>Firing Rates and Spike Statistics - Introduction, Spike Trains and Firing Rates, Spike-Train Statistics, The Neural Code, Reverse Correlation and Visual Receptive Fields - Introduction, Estimating Firing Rates, Reverse-Correlation Methods: Simple Cells, Static Nonlinearities: Complex Cells, Receptive Fields in the Retina and LGN, Constructing V1 Receptive Fields, Neural Decoding - Encoding and Decoding, Discrimination, Population Decoding, Spike-Train Decoding | [9] |
| **Neurons and Neural Circuits**<br>Neuro electronics - Introduction, Electrical Properties of Neurons, Single-Compartment Models, Integrate-and-Fire Models, Voltage-Dependent Conductances, Modeling Channels, Synaptic Conductances, Synapses on Integrate-and-Fire Neurons, Conductances and Morphology - Levels of Neuron Modeling, Conductance - Based Models, The Cable Equation, Multi-compartment Models, Network Models | [9] |
| **Adaptation and Learning**<br>Plasticity and Learning - Introduction, Synaptic Plasticity Rules, Unsupervised Learning, Supervised Learning, Classical Conditioning and Reinforcement Learning - Introduction, Classical Conditioning, Static Action Choice, Sequential Action Choice, Representational Learning - Introduction, Density Estimation, Causal Models for Density Estimation. | [9] |
| **Computational Neuroscience and Neural networks**<br>Introduction, Mathematical Preliminaries, Organization of nervous system and Neuro anatomy, Hodgkin Huxley model, Biophysical models of Single neuron, Simplified neuron models, Introduction to Neural networks, basic neurons, multilayer perceptron, Back propagation algorithm. Hopfield network | [9] |
| **Total Hours** | **45** |

**Text book(s)**

| | |
|---|---|
| 1. | 'Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems', by Peter Dayan and Larry F. Abbott. The MIT Press,2001.ISBN 0-262-04199-5 |
| 2. | 'An Introductory Course in Computational Neuroscience', by P. Millerm MIT Press (2018), 1st edition. ISBN 978-0-262038256 |

**Reference(s):**

| | |
|---|---|
| 1. | 'Mathematical Foundations of Neuroscience', by G. B. Ermentrout & D. H. Terman - Springer (2010), 1st edition. ISBN 978-0-387-87707-5 |
| 2. | 'Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting', by Eugene M. Izhikevich. The MIT Press, 2007. ISBN 0-262-09043-8 |
| 3. | Patricia Churcland & Terence Sejnowski,Computaional Brain,MIT Press |
| 4. | Christof Koch, Biophysics of computation: information processing in single neurons, Oxford University Press, 2005 |



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**Course Contents and Lecture Schedule**

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Fundamentals of Neuroscience** | |
| 1.1 | Introduction | 1 |
| 1.2 | General Features and Cells of the Nervous System | 1 |
| 1.3 | Neural Signaling | 1 |
| 1.4 | Synaptic Transmission | 1 |
| 1.5 | Chemical Senses | 1 |
| 1.6 | The Auditory System | 1 |
| 1.7 | The Visual System | 1 |
| 1.8 | Cognition and Memory | 1 |
| 1.9 | Development of the Nervous System | 1 |
| **2** | **Neural Encoding and Decoding** | |
| 2.1 | Firing Rates and Spike Statistics - Introduction | 1 |
| 2.2 | Spike Trains and Firing Rates, Spike-Train Statistics | 1 |
| 2.3 | The Neural Code | 1 |
| 2.4 | Reverse Correlation and Visual Receptive Fields - Introduction | 1 |
| 2.5 | Estimating Firing Rates, Reverse-Correlation Methods: Simple Cells, Static Nonlinearities: Complex Cells | 1 |
| 2.6 | Receptive Fields in the Retina and LGN | 1 |
| 2.7 | Constructing V1 Receptive Fields, Neural Decoding - Encoding and Decoding | 1 |
| 2.8 | Discrimination, Population Decoding | 1 |
| 2.9 | Spike-Train Decoding | 1 |
| **3** | **Neurons and Neural Circuits** | |
| 3.1 | Neuroelectronics - Introduction, Electrical Properties of Neurons | 1 |
| 3.2 | Single-Compartment Models | 1 |
| 3.3 | Integrate-and-Fire Models, Voltage-Dependent Conductances | 1 |
| 3.4 | Modeling Channels, Synaptic Conductances | 1 |
| 3.5 | Synapses on Integrate-and-Fire Neurons | 1 |
| 3.6 | Conductances and Morphology - Levels of Neuron Modeling | 1 |
| 3.7 | Conductance - Based Models | 1 |
| 3.8 | The Cable Equation | 1 |
| 3.9 | Multi-compartment Models, Network Models | 1 |
| **4** | **Adaptation and Learning** | |
| 4.1 | Plasticity and Learning - Introduction | 1 |
| 4.2 | Synaptic Plasticity Rules | 1 |
| 4.3 | Unsupervised Learning, Supervised Learning | 1 |
| 4.4 | Classical Conditioning and Reinforcement Learning - Introduction | 1 |
| 4.5 | Classical Conditioning | 1 |
| 4.6 | Static Action Choice, Sequential Action Choice | 1 |
| 4.7 | Representational Learning - Introduction | 1 |
| 4.8 | Density Estimation | 1 |
| 4.9 | Causal Models for Density Estimation. | 1 |
| **5** | **Computational Neuroscience and Neural networks** | |
| 5.1 | Introduction, Mathematical Preliminaries | 1 |



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| | | |
|---|---|---|
| 5.2 | Organization of nervous system and Neuroanatomy | 1 |
| 5.3 | Hodgkin Huxley model | 1 |
| 5.4 | Biophysical models of Single neuron | 1 |
| 5.5 | Simplified neuron models | 1 |
| 5.6 | Introduction to Neural networks | 1 |
| 5.7 | basic neurons, multilayer perceptron | 1 |
| 5.8 | Backpropagation algorithm | 1 |
| 5.9 | Hopfield network | 1 |
| | **Total** | **45** |

## Course Designers

Dr.C.Nallusamy (nallusamyc@ksrct.ac.in)



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| 60 PDS E63 | Fog Computing | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PC | 3 | 0 | 0 | 3 |

**Objective**

- To learn the basic concepts of fog computing
- To familiarize the management of Network Slices in 5G,Fog, Edge, and Clouds
- To provide the requirements of fog computing when applied to IoT
- To develop the application of fog computing in health monitoring
- To implement software defined networking application

**Prerequisite**

Basic knowledge of Data Science, Cloud Computing IoT

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explore the fundamentals of fog computing | Understand |
| CO2 | Explain the management of Network Slices in 5G,Fog, Edge, and Clouds | Analyse |
| CO3 | Analyse fog computing requirements in IoT | Analyse |
| CO4 | Utilize fog computing in health monitoring applications | Apply |
| CO5 | Implement software defined networking application in fog computing | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | 3 | 1 | 1 |
| CO2 | 2 | 2 | 2 | 3 | 1 | 1 |
| CO3 | 2 | 2 | 2 | 3 | 1 | 1 |
| CO4 | 2 | 2 | 2 | 3 | 1 | 1 |
| CO5 | 2 | 2 | 2 | 3 | 1 | 1 |
| 3-Strong;2-Medium;1-Some | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 20 | 10 | 20 |
| Understand (Un) | 20 | 20 | 30 |
| Apply (Ap) | 10 | 10 | 20 |
| Analyse (An) | 10 | 20 | 30 |
| Evaluate (Ev) | 00 | 00 | 00 |
| Create (Cr) | 00 | 00 | 00 |



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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PDS E63 – FOG COMPUTING** | | | | | | | | |
| **PDS: M.TECH DATA SCIENCE** | | | | | | | | |
| Semester | Hours / Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 60 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Fog Computing**<br>Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing Architecture: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction ,IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies. | [9] |
| **Management and Orchestration of Network Slices in 5G,Fog, Edge, and Clouds**<br>Introduction, Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog, Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds, IoT Integration, Security Management for Edge Cloud Architectures. Fog Computing Realization for Big Data Analytics Introduction to Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation. | [9] |
| **Fog computing requirements when applied to IoT**<br>Scalability, Interoperability, Fog-IoT architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, Data Management, filtering, Event Management, Device Management, Cloudification, virtualization, security and privacy issues. Integrating IoT, Fog, and Cloud Infrastructures: Methodology, Integrated C2F2T Literature by Modeling Technique by Use-Case Scenarios, Integrated C2F2T Literature by Metrics. | [9] |
| **Exploiting Fog Computing in Health Monitoring**<br>An Architecture of a Health Monitoring IoT Based System with Fog Computing, Fog Computing Services in Smart E-Health Gateways, Discussion of Connected Components. Fog Computing Model for Evolving Smart Transportation Applications: Introduction , Data-Driven Intelligent Transportation Systems , Fog Computing for Smart Transportation Applications Case Study: Intelligent Traffic Lights Management (ITLM) System | [9] |
| **Software Defined Networking and application in Fog Computing**<br>Open Flow Protocol, Open Flow Switch, SDN in Fog Computing, Home Network using SDN. Security and Privacy issues: Trust and privacy issues in IoT Network, web Semantics and trust Management for Fog Computing, Machine Learning based security in Fog Computing, Cyber- Physical Energy Systems over Fog Computing**.** | [9] |
| **Total Hours** | **45** |

| **Text book(s)** | |
|---|---|
| 1. | Assad Abbas, Samee U. Khan, Albert Y. Zomaya , “Fog Computing: Theory and Practice”, John Wiley & Sons, 2020 |
| 2. | Rajkumar Buyya, Satish Narayana Srirama , “Fog and Edge Computing: Principles and Paradigms”, Wiley publication, 2019, |
| **Reference(s):** | |
| 1. | SudipMisra , Subhadeep Sarkar , Subarna Chatterjee,”Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things “. CRC Press 2019. |
| 2. | K.G. Srinivasa , Pankaj Lathar , G.M. Siddesh,”The Rise of Fog Computing in the Digital Era “,IGI Global,2018. |
| 3. | Ravi Tomar, Avita Katal, Susheela Dahiya, Niharika Singh, Tanupriya Choudhury, “Fog Computing Concepts, Frameworks, and Applications “, Taylor & Francis , 2022. |
| 4. | https://github.com/CLoudslab/iFogSimTutorials |



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Course Contents and Lecture Schedule

| S.No. | Topic | No.of Hours |
|---|---|---|
| **1** | **Introduction to Fog Computing** | |
| 1.1 | Fog Computing, Characteristics, Application Scenarios, Issues and challenges | 1 |
| 1.2 | Fog Computing Architecture | 1 |
| 1.3 | Communication and Network Model, Programming Models | 1 |
| 1.4 | Fog Architecture for smart cities, healthcare and vehicles | 1 |
| 1.5 | Fog Computing Communication Technologies - IEEE 802.11 | 1 |
| 1.6 | 4G,5G standards | 1 |
| 1.7 | WPAN, Short-Range Technologies | 1 |
| 1.8 | LPWAN | 1 |
| 1.9 | Medium and Long-Range Technologies | 1 |
| **2** | **Management and Orchestration of Network Slices in 5G,Fog, Edge, and Clouds**, ,. | |
| 2.1 | Introduction, Background, Network Slicing in 5G | 1 |
| 2.2 | Network Slicing in Software | 1 |
| 2.3 | Network Slicing Management in Edge and Fog | 1 |
| 2.4 | Middleware for Fog and Edge Computing | 1 |
| 2.5 | Middleware, Clusters for Lightweight Edge Clouds, IoT Integration | 1 |
| 2.6 | Management for Edge Cloud Architectures | 1 |
| 2.7 | Fog Computing Realization for Big Data Analytics | 1 |
| 2.8 | Data Analytics in the Fog | 1 |
| 2.9 | Prototypes and Evaluation | 1 |
| **3** | **Fog computing requirements when applied to IoT** | |
| 3.1 | Scalability, Interoperability, Fog- IoT architectural model | 1 |
| 3.2 | Challenges on IoT Stack Model via TCP/IP | 1 |
| 3.3 | Architecture, Data Management, filtering Event Management | 2 |
| 3.4 | Device Management, Cloudification, Virtualization | 1 |
| 3.5 | Security and privacy issues | 1 |
| 3.6 | Integrating IoT, Fog, Cloud Infrastructures: Methodology , Integrated C2F2T | 2 |
| 3.7 | Literature by Modeling Technique by Use-Case Scenarios | 1 |
| 3.8 | Integrated C2F2T Literature by Metrics | 1 |
| **4** | **Exploiting Fog Computing in Health Monitoring** | |
| 4.1 | An Architecture of a Health Monitoring IoT Based System with Fog Computing | 1 |
| 4.2 | Fog Computing Services in Smart E-Health Gateways | 1 |
| 4.3 | Discussion of Connected Components | 1 |
| 4.4 | Fog Computing Model for Evolving Smart Transportation | 1 |
| 4.5 | Data-Driven Intelligent Transportation Systems | 1 |
| 4.6 | Fog Computing for Smart Transportation | 2 |
| 4.7 | Applications Case Study: Intelligent Traffic Lights Management (ITLM) System | 2 |
| **5** | **Software Defined Networking and application in Fog Computing** | |
| 5.1 | Open Flow Protocol, Open Flow Switch | 1 |
| 5.2 | SDN in Fog Computing, Home Network using SDN | 2 |
| 5.3 | Trust and privacy issues in IoT Network | 1 |
| 5.4 | Web Semantics and trust Management for Fog Computing | 1 |

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| | | |
|---|---|---|
| 5.5 | Machine Learning based security in Fog Computing | 2 |
| 5.6 | Cyber- Physical Energy Systems over Fog Computing | 2 |
| **Practice** | | |
| P.1 | Understand the tools and libraries in iFogSim | 6 |
| P.2 | Implemention of a topology in iFogSim | 4 |
| P.3 | Testing of services and scenarios in a controllable environment of iFogSim | 5 |
| | **Total** | **45 + 15 = 60** |

## Course Designers

Dr.J.Nithya - nithyaj@ksrct.ac.in



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| 60 PDS E64 | Healthcare Data Analytics | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objective**

- Understand the health data formats, health care policy and standards
- Learn the significance and need of data analysis and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analytics for critical care applications

Prerequisite

Machine Learning, Deep Learning

Course Outcomes

| | | |
|---|---|---|
| CO1 | Understand machine learning and deep learning algorithms for health data analysis | Understand |
| CO2 | Remember the data management techniques for healthcare data | Remember |
| CO3 | Analyse the need of healthcare data analysis in e-healthcare, telemedicine and other critic care applications | Analyse |
| CO4 | Design health data analytics for real time applications | Apply |
| CO5 | Design emergency care system using health data analysis | Apply |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | 1 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 1 |
| CO3 | 3 | 3 | 2 | 3 | 2 | 1 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 1 |
| CO5 | 3 | 2 | 2 | 3 | 2 | 1 |
| 3-Strong;2-Medium;1-Some | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 30 | 00 | 10 |
| Understand (Un) | 30 | 00 | 60 |
| Apply (Ap) | 00 | 30 | 30 |
| Analyse (An) | 00 | 30 | 00 |
| Evaluate (Ev) | 00 | 00 | 00 |
| Create (Cr) | 00 | 00 | 00 |



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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PDS E64- Healthcare Data Analytics** | | | | | | | | |
| **PDS: M.TECH DATA SCIENCE** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction To Healthcare Analysis**<br>Overview – History of Healthcare Analysis Parameters on medical care systems – Health Care Policy – Standardized Code Sets – Data Formats – Machine Learning Foundations: Tree Like reasoning, Probabilistic reasoning and Bayes Theorem, Weighted sum approach. | **[9]** |
| **Health Care Management**<br>IOT – Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare. | **[9]** |
| **Healthcare And Deep Learning**<br>Introduction on Deep Learning – DFF network CNN – RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System. | **[9]** |
| **Machine Learning In Health Care**<br>Introduction – Medical Imaging and Diagnosis – Medical Data – Treatment and Prediction of Disease – Smart Health Records – Clinical Trial and Research – Personalized Medicine. | **[9]** |
| **Artificial Intelligence And Machine Learning Applications**<br>Predicting Mortality for cardiology Practice – Smart Ambulance System using IOT – Hospital Acquired Conditions (HAC) program – Healthcare and Emerging Technologies – ECG Data Analysis. | **[9]** |
| **Total Hours** | **45** |

| **Textbook(s):** | |
|---|---|
| 1. | Chandan K.Reddy, Charu C. Aggarwal, 'Health Care data Analysis', First edition, CRC, 2015. |
| 2. | Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhatl, 'Health Care Data Analysis and Management', First Edition, Academic Press, 2018. |
| **Reference(s):** | |
| 1. | Vikas Kumar, 'Health Care Analysis Made Simple', Packt Publishing, 2018 |
| 2. | Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, 'Big Data Analytics in HealthCare', Springer, 2020 |
| 3. | Hui Jang, Eva K.Lee, 'HealthCare Analysis: From Data to Knowledge to Healthcare Improvement', First Edition, Wiley, 2016 |
| 4. | Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhatl, 'Health Care Data Analysis and Management', First Edition, Academic Press, 2018. |



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## Course Contents and Lecture Schedule

| S.No. | Topic | No. of Hours |
|---|---|---|
| **1.0** | **Introduction To Healthcare Analysis** | |
| 1.1 | Overview | 1 |
| 1.2 | History of Healthcare Analysis Parameters on medical care systems | 1 |
| 1.3 | Health Care Policy | 1 |
| 1.4 | Standardized Code Sets | 1 |
| 1.5 | Data Formats | 1 |
| 1.6 | Machine Learning Foundations: | 1 |
| 1.7 | Tree Like reasoning | 1 |
| 1.8 | Probabilistic reasoning and Bayes Theorem, | 1 |
| 1.9 | Weighted sum approach. | 1 |
| **2.0** | **Health Care Management** | |
| 2.1 | IOT | 1 |
| 2.2 | Smart Sensors | 1 |
| 2.3 | Migration of Healthcare Relational database to NoSQL Cloud Database | 1 |
| 2.4 | Decision Support System | 1 |
| 2.5 | Matrix block Cipher System | 1 |
| 2.6 | Semantic Framework Analysis | 1 |
| 2.7 | Histogram bin Shifting and Rc6 Encryption | 1 |
| 2.8 | Clinical Prediction Models | 1 |
| 2.9 | Visual Analytics for Healthcare | 1 |
| **3.0** | **Healthcare And Deep Learning** | |
| 3.1 | Introduction on Deep Learning | 1 |
| 3.2 | DFF network CNN | 1 |
| 3.3 | RNN for Sequences | 1 |
| 3.4 | Biomedical Image and Signal Analysis | 1 |
| 3.5 | Natural Language Processing– | 1 |
| 3.6 | Data Mining for Clinical Data | 2 |
| 3.7 | Mobile Imaging and Analytics | 1 |
| 3.8 | Clinical Decision Support System | 1 |
| **4.0** | **Machine Learning In Health Care** | |
| 4.1 | Introduction | 1 |
| 4.2 | Medical Imaging and Diagnosis | 1 |
| 4.3 | Medical Data | 2 |
| 4.4 | Treatment and Prediction of Disease | 1 |
| 4.5 | Smart Health Records | 1 |
| 4.6 | Clinical Trial | 1 |
| 4.7 | Research | 1 |
| 4.8 | Personalized Medicine | 1 |
| **5.0** | **Artificial Intelligence And Machine Learning Applications** | |
| 5.1 | Predicting Mortality for cardiology Practice | 1 |
| 5.2 | Smart Ambulance System using IOT | 2 |
| 5.3 | Hospital Acquired Conditions (HAC) program | 2 |
| 5.4 | Healthcare and Emerging Technologies | 2 |
| 5.5 | ECG Data Analysis | 2 |
| | **Total** | **45** |

## Course Designers

1.Mr.P.Dineshkumar – p.dineshkumar@ksrct.ac.in

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| 60 PDS E65 | Real Time Systems | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | PE | 3 | 0 | 0 | 3 |

**Objectives**

- Define various Real Time systems Application
- Discuss a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
- Demonstrate the in-depth hands-on experience in designing and developing a real operational system.
- Differentiate and distinguish architectural design of a real-time system
- Compare different Task scheduling, resource management, real-time operating systems and fault tolerant methods of Real-Time Systems.

**Prerequisite**

Basic knowledge of Operating System.

**Course Outcomes**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO1 | Explain the fundamentals of Real time systems and its classifications. | Remember |
| CO2 | Understand the concepts of computer control and the suitable computer hardware requirements for real-time applications. | Understand |
| CO3 | Describe the operating system concepts and techniques required for real time systems. | Apply |
| CO4 | Develop the software algorithms using suitable languages to meet Real time applications. | Apply |
| CO5 | Apply suitable methodologies to design and develop Real-Time Systems. | Analyse |

**Mapping with Programme Outcomes**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 2 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 2 | 3 |
| 3-Strong;2-Medium;1-Some | | | | | | |

**Assessment Pattern**

| Bloom's Category | Continuous Assessment Tests (Marks) | | End Sem Examination (Marks) |
|---|---|---|---|
| | 1 | 2 | |
| Remember (Re) | 30 | 20 | 30 |
| Understand (Un) | 30 | 20 | 30 |
| Apply (Ap) | - | 20 | 20 |
| Analyse (An) | - | - | 20 |
| Evaluate (Ev) | - | - | - |
| Create (Cr) | - | - | - |



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| **K.S.Rangasamy College of Technology – Autonomous R2022** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **60 PDS E65 -Real Time Systems** | | | | | | | | |
| **PDS: M.TECH DATA SCIENCE** | | | | | | | | |
| Semester | Hours/Week | | | Total hrs | Credit | Maximum Marks | | |
| | L | T | P | | C | CA | ES | Total |
| III | 3 | 0 | 0 | 45 | 3 | 40 | 60 | 100 |

| | |
|---|---|
| **Introduction to Real-Time Systems:**<br>Historical background, Elements of a Computer Control System, RTS- Definition, Classification of Real-time Systems, Time Constraints, Classification of Programs. Sequence Cfontrol, Loop Control, Supervisory Control | **[9]** |
| **Computer Hardware Requirements for Real-Time Applications**<br>Introduction, General Purpose Computer, Single Chip Microcomputers and Microcontrollers, Specialized Processors, Process-Related Interfaces, Data Transfer Techniques, Communications, Standard Interface. | **[9]** |
| **Languages for Real-Time Applications**<br>Introduction, Syntax Layout and Readability, Declaration and Initialization of Variables and Constants, Cutlass, Modularity and Variables, Compilation of Modular Programs, Data types, Control Structures, Exception Handling, and Low-level facilities, Co-routines, Interrupts and Device Handling, Concurrency, Real-Time Support, Overview of Real-Time Languages. | **[9]** |
| **Operating Systems**<br>Introduction, Real-Time Multi-Tasking OS, Scheduling Strategies, Priority Structures, Task Management, Scheduler and Real-Time Clock Interrupt Handler, Memory Management, Code Sharing, Resource Control, Task Co-Operation and Communication, Mutual Exclusion. | **[9]** |
| **Design of RTS- General Introduction**<br>Introduction, Specification Docwnent, Preliminary Design. Single-Program Approach, Foreground/Background System - Introduction, Yow-don Methodology, Ward and Mellor Method, Hately and Pirbhai Method. | **[9]** |
| **Total Hours** | **45** |

| **Textbook(s):** | |
|---|---|
| 1. | Real-Time Computer Control, Stuart Bennet, Second Edition. Pearson Education. 2008. |
| 2. | Real Time Systems – Jane W. S. Liu, Pearson Education Publication |
| **Reference(s):** | |
| 1. | 'Real-Time Systems', C.M. Krishna, Kang G Shin, McGraw-Hill International Editions, 1997. |
| 2. | Real-Time Systems Design and Analysis, Phillip. A. Laplante, second edition, PHI, 2005. |
| 3. | Embedded Systems, Raj Kamal, Tata McGraw Hill, India, third edition, 2005. |
| 4. | Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley. |



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## Course Contents and Lecture Schedule

| S.No. | Topic | No. of Hours |
|---|---|---|
| **1.0** | **Introduction to Real-Time Systems** | |
| 1.1 | Historical background | 1 |
| 1.2 | Elements of a Computer Control System | 1 |
| 1.3 | RTS- Definition | 1 |
| 1.4 | Classification of Real-time Systems | 1 |
| 1.5 | Time Constraints | 1 |
| 1.6 | Classification of Programs | 1 |
| 1.7 | Sequence Control | 1 |
| 1.8 | Loop Control | 1 |
| 1.9 | Supervisory Control | 1 |
| **2.0** | **Computer Hardware Requirements for Real-Time Applications** | |
| 2.1 | Introduction | 1 |
| 2.2 | General Purpose Computer | 1 |
| 2.3 | Single Chip Microcomputers | 1 |
| 2.4 | Microcontrollers | 1 |
| 2.5 | Specialized Processors | 1 |
| 2.6 | Process-Related Interfaces | 1 |
| 2.7 | Data Transfer Techniques | 1 |
| 2.8 | Communications | 1 |
| 2.9 | Standard Interface | 1 |
| **3.0** | **Languages for Real-Time Applications** | |
| 3.1 | Introduction, Syntax Layout and Readability | 1 |
| 3.2 | Declaration and Initialization of Variables and Constants | 1 |
| 3.3 | Cutlass, Modularity and Variables | 1 |
| 3.4 | Compilation of Modular Programs | 1 |
| 3.5 | Data types, Control Structures, Exception Handling | 1 |
| 3.6 | Low-level facilities, Co-routines, Interrupts and Device Handling, Concurrency | 2 |
| 3.7 | Real-Time Support | 1 |
| 3.8 | Overview of Real-Time Languages | 1 |
| **4.0** | **Operating Systems** | |
| 4.1 | Introduction, Real-Time Multi-Tasking OS | 1 |
| 4.2 | Scheduling Strategies, Priority Structures | 1 |
| 4.3 | Task Management | 2 |
| 4.4 | Scheduler and Real-Time Clock Interrupt Handler | 1 |
| 4.5 | Memory Management | 1 |
| 4.6 | Code Sharing, Resource Control | 1 |
| 4.7 | Task Co-Operation and Communication | 1 |
| 4.8 | Mutual Exclusion | 1 |
| **5.0** | **Design of RTS- General Introduction** | |
| 5.1 | Introduction, Specification Document | 1 |
| 5.2 | Preliminary Design | 1 |
| 5.3 | Single-Program Approach | 2 |
| 5.4 | Foreground/Background System | 1 |
| 5.5 | Yow-don Methodology | 1 |
| 5.6 | Ward and Mellor Method | 2 |
| 5.7 | Hately and Pirbhai Method. | 1 |
| | **Total** | **45** |

## Course Designers

1. K Senthil Kumar – senthilkumark@ksrct.ac.in

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<table>
<tr><th colspan="8">K.S.Rangasamy College of Technology – Autonomous R2022</th></tr>
<tr><th colspan="8">PDS: M.TECH DATA SCIENCE</th></tr>
<tr><th colspan="8">60 PDS 3P1 – Project Work Phase - I</th></tr>
<tr><th rowspan="2">Semester</th><th colspan="3">Hours/Week</th><th rowspan="2">Total Hours</th><th>Credit</th><th colspan="2">Maximum Marks</th></tr>
<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CA</th><th>ES</th><th>Total</th></tr>
<tr><td>III</td><td>0</td><td>0</td><td>12</td><td>60</td><td>6</td><td>100</td><td>-</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">• To import the practical knowledge to the students and also to make them to carry out the technical procedures in their project work.<br>• To provide an exposure to the students to refer, read and review the research articles, journals and conference proceedings relevant to their project work and placing this as their beginning stage for their final presentation.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">At the end of the course, the students will be able to<br>1. Survey the relevant literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.<br>2. Use different experimental techniques/different software/computational/analytical tools.<br>3. Design and develop an experimental set up/ equipment/testing.<br>4. Conduct tests on existing set ups/equipment and draw logical conclusions from the results after analyzing them.<br>5. Work in a research environment or in an industrial environment.</td></tr>
<tr><td colspan="8">The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M.E/M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report.<br>The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.</td></tr>
</table>



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**Assessment Pattern**

**Internal Assessment: 100 Marks**

| **Review I (R1)** | | | **Review II (R2)** | | **Review III (R3)** | | | **Total (R1+R2+R3)** | **Internal** |
|---|---|---|---|---|---|---|---|---|---|
| Literature Survey | Topic Identification & Justification | Work Plan | Approach | Conclusion | Demo-Existing System | Presentation | Report | Total | |
| 10 | 10 | 10 | 20 | 20 | 10 | 10 | 10 | 100 | 100 |



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**K.S.RANGASAMY COLLEGE OF TECHNOLOGY, TIRUCHENGODE-637215**

**(An Autonomous Institution affiliated to Anna University)**

**M. Tech. Degree Programme**

**SCHEME OF EXAMINATIONS**

**(For the candidates admitted in 2024 - 2025)**

**FOURTH SEMESTER**

| S.No. | Course Code | Name of the Course | Duration of Internal Exam | Weightage of Marks | | | Minimum Marks for Pass in End Semester Exam | |
|---|---|---|---|---|---|---|---|---|
| | | | | Continuous Assessment * | End Semester Exam ** | Max. Marks | End Semester Exam | Total |
| **PRCTICAL** | | | | | | | | |
| 1. | 60 PDS 4P1 | Project Work Phase - II | 2 | 60 | 40 | 100 | 45 | 100 |

* CA evaluation pattern will differ from course to course and for different tests. This will have to be declared in advance to students. The department will put a process in place to ensure that the actual test paper follow the declared pattern.

** End Semester Examination will be conducted for maximum marks of 100 and subsequently be reduced to 60 marks for theory End Semester Examination and 40 marks for project work End Semester Examination.



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<table>
<tr><th colspan="8">K.S.Rangasamy College of Technology – Autonomous R2022</th></tr>
<tr><th colspan="8">PDS: M.TECH DATA SCIENCE</th></tr>
<tr><th colspan="8">60 PDS 4P1 – Project Work Phase - II</th></tr>
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<tr><th>L</th><th>T</th><th>P</th><th>C</th><th>CA</th><th>ES</th><th>Total</th></tr>
<tr><td>III</td><td>0</td><td>0</td><td>24</td><td>60</td><td>12</td><td>60</td><td>40</td><td>100</td></tr>
<tr><td>Objective(s)</td><td colspan="7">• This enables and strengthens the students to carry out the project on their own and to implement their innovative ideas to forefront the risk issues and to retrieve the hazards by adopting suitable assessment methodologies and staring it to global.</td></tr>
<tr><td>Course Outcomes</td><td colspan="7">At the end of the course, the students will be able to<br>1. Develop attitude of lifelong learning and will develop interpersonal skills to deal with people working in diversified field will.<br>2. Write technical reports and research papers to publish at national and international level.<br>3. Develop strong communication skills to defend their work in front of technically qualified audience.</td></tr>
<tr><td colspan="8">The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M.E/M. Tech. The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report.<br>The work has to be presented in front of the examiners panel set by Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.</td></tr>
</table>



CHAIRMAN
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