MAHENDRA ENGINEERING COLLEGE
(Autonomous)
Accredited by NAAC 'A' Grade & NBA Tier-I (WA) UG: CSE,ECE,EEE
Mahendhirapuri, Mallasamudram, Namakkal Dt. - 637 503.

# B.TECH
# ARTIFICIAL INTELLIGENCE & DATA SCIENCE

## CURRICULUM

### CHOICE BASED CREDIT SYSTEM (CBCS)

### REGULATIONS - 2022

**MAHENDRA ENGINEERING COLLEGE**

**(AUTONOMOUS)**

**MAHENDHIRAPURI, MALLASAMUDRAM,**

**NAMAKKAL Dt. TAMIL NADU- 637503**

**MAHENDRA ENGINEERING COLLEGE,**
**(AUTONOMOUS)**

# MAHENDRA ENGINEERING COLLEGE
# MALLASAMUDRAM WEST, TAMIL NADU 637503
# DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

**Institute Vision**

- To be an internationally recognized institute for engineering education and research with ethical values.

**Institute Mission**

- To ensure the effective use of resources to mould the students as professionals and entrepreneurs
- To enhance industry institute interaction for innovative technology practice
- To encourage the faculty members and students for advanced research
- To inculcate ethical values among the faculty members and students

**Department Vision**

- To be a centre of excellence in the domain of Artificial Intelligence and Data Science and produce globally competent professionals to solve futuristic societal challenges.
-

**Department Mission**

- To establish a unique learning environment and enable the students to equip with skills and face the challenges in Artificial Intelligence and Data Science.
- To impart knowledge in cutting edge Artificial Intelligence and Data Science technologies as per industrial standards.
- To inculcate research and life-long learning skills to serve the society at large.
- To inculcate professional ethics, rules and life skills.

**Programme Educational Objectives**

- PEO1 – To impart knowledge to create, analyze and design novel solutions required for broader social context.
- PEO2 – To design and develop solutions for real-world problems based on professional and societal needs.
- PEO3 – To engage in constructive research, professional development and life-long learning to conversant with emerging technologies.

**Programme Specific Outcomes**

1. PSO1 - Demonstrate AI and data analysis skills to achieve effective insights and decision making to solve real-life problems.
2. PSO2 - Apply mathematical and statistical models to solve the computational tasks, and model real-world problems using appropriate AI / ML algorithms.

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulations 2022**

**I Semester**

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22MA12101 | Engineering Mathematics –I | 3 | 1 | 0 | 4 | BS |
| 2 | 22PY12101 | Engineering Physics | 3 | 0 | 0 | 3 | BS |
| 3 | 22CS13001 | Problem Solving Techniques using C | 3 | 0 | 0 | 3 | ES |
| 4 | 22EE13101 | Basics of Electrical and Electronics Engineering | 2 | 0 | 2 | 3 | ES |
| 5 | 22CS13101 | Digital Logic & Microprocessors | 3 | 0 | 0 | 3 | ES |
| 6 | | Induction Program | - | - | - | - | MC |
| 7 | | □□□□□□ □□□□ /Heritage of Tamils | 0 | 0 | 0 | 1 | MC |
| | **PRACTICAL** | | | | | | |
| 8 | 22PY22001 | Physics Lab | 0 | 0 | 3 | 1.5 | BS |
| 9 | 22CS23001 | Problem Solving Techniques using C | 1 | 0 | 3 | 1.5 | ES |
| | | **TOTAL** | **15** | **1** | **8** | **20** | |

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulations 2022**

## II Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22MA12102 | Engineering Mathematics –II | 3 | 1 | 0 | 4 | BS |
| 2 | 22CY12001 | Chemistry for Engineering | 3 | 0 | 0 | 3 | BS |
| 3 | 22EN11001 | Communicative English | 3 | 0 | 0 | 3 | HS |
| 4 | 22GE13001 | Engineering Graphics and Design | 3 | 0 | 2 | 4 | ES |
| 5 | 22CS13201 | Data Structures | 4 | 0 | 0 | 4 | ES |
| 6 | | □□□□□□□□ □□□□□□□□□□□□□□□ / Tamils and Technology | 0 | 0 | 0 | 1 | MC |
| | **PRACTICAL** | | | | | | |
| 7 | 22CY22001 | Chemistry Laboratory | 0 | 0 | 3 | 1.5 | BS |
| 8 | 22CS23201 | Data Structures Laboratory | 0 | 0 | 3 | 1.5 | ES |
| 9 | 22EN21001 | Personality Development Practice Lab | 1 | 0 | 2 | 1 | HS |
| | | **TOTAL** | **17** | **1** | **10** | **23** | |

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulations 2022**

## III Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22MA12301 | Probability and Discrete Mathematics | 3 | 1 | 0 | 4 | BS |
| 2 | 22AI14301 | Application Based Programming In Python | 3 | 0 | 0 | 3 | PC |
| 3 | 22AI14302 | Computer Architecture and Organization | 3 | 0 | 0 | 3 | PC |
| 4 | 22AI14303 | Database Technology | 3 | 0 | 0 | 3 | PC |
| 5 | | Open Elective - 1 | 2 | 1 | 0 | 3 | OE |
| 6 | 22CY11001 | Environmental Science | 3 | 0 | 0 | - | MC |
| | **PRACTICAL** | | | | | | |
| 7 | 22AI24301 | Application Based Programming In Python Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 8 | 22AI24302 | Database Technology Laboratory | 0 | 0 | 3 | 1.5 | PC |
| | | **TOTAL** | **17** | **2** | **6** | **19** | |

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## IV Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22SH11401 | Universal Human Values | 3 | 0 | 0 | 3 | MC |
| 2 | 22AI14401 | Foundations of Data Science | 3 | 0 | 0 | 3 | PC |
| 3 | 22AI14402 | Introduction To Artificial Intelligence | 3 | 0 | 0 | 3 | PC |
| 4 | 22CS14403 | Java Programming | 3 | 0 | 0 | 3 | PC |
| 5 | | Program Elective – I | 3 | 0 | 0 | 3 | PE |
| 6 | | Open Elective - 2 | 3 | 0 | 0 | 3 | OE |
| | **PRACTICAL** | | | | | | |
| 7 | 22AI24401 | Artificial Intelligence and Java Programming Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 8 | 22AI24402 | Operating Systems (Integrated) | 2 | 0 | 2 | 3 | PC |
| 9 | 22EN60001 | Professional Communicative Skills | 0 | 1 | 2 | 2 | HS |
| | | **TOTAL** | **20** | **1** | **7** | **24.5** | |

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## V Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22AI14501 | Big Data Analytics | 3 | 0 | 0 | 3 | PC |
| 2 | 22AI14502 | Machine Learning Techniques | 3 | 0 | 0 | 3 | PC |
| 3 | | Program Elective – 2 | 3 | 0 | 0 | 3 | PE |
| 4 | | Open Elective - 3 | 3 | 0 | 0 | 3 | OE |
| 5 | | Open Elective - 4 | 2 | 1 | 0 | 3 | OE |
| 6 | | Constitution of India | 3 | 0 | 0 | - | MC |
| | **PRACTICAL** | | | | | | |
| 7 | 22AI24501 | Big Data Analytics Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 8 | 22AI24502 | Machine Learning Techniques Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 9 | | Interview Skills and Soft Skills | 0 | 1 | 3 | 2 | HS |
| | | **TOTAL** | **17** | **2** | **9** | **20** | |

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## VI Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | | Managerial Skills, Project and Quality Management | 3 | 0 | 0 | 3 | HS |
| 2 | 22AI14601 | Deep Learning | 3 | 0 | 0 | 3 | PC |
| 3 | 22AI14602 | Natural Language Processing | 3 | 0 | 0 | 3 | PC |
| 4 | 22AI14603 | Healthcare Analytics | 3 | 0 | 0 | 3 | PC |
| 5 | | Program Elective-3 | 3 | 0 | 0 | 3 | PE |
| 6 | | Open Elective-5 | 3 | 0 | 0 | 3 | OE |
| | **PRACTICAL** | | | | | | |
| 7 | 22AI24601 | Deep Learning Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 8 | 22AI24602 | Natural Language Processing Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 9 | 22AI26601 | Mini Project | 0 | 0 | 6 | 3 | EEC |
| | | **TOTAL** | **18** | **0** | **12** | **24** | |
| | | | | | | | |

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## VII Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22AI14701 | Computer Vision | 3 | 0 | 0 | 3 | PC |
| 2 | 22AI14702 | Data Security | 3 | 0 | 0 | 3 | PC |
| 3 | 22AI14703 | Reinforcement Learning | 3 | 0 | 0 | 3 | PC |
| 4 | 22AI14704 | Text And Speech Analytics | 3 | 0 | 0 | 3 | PC |
| 5 | | Program Elective – 4 | 3 | 0 | 0 | 3 | PE |
| 6 | | (Open Elective-6) | 3 | 0 | 0 | 3 | OE |
| | **PRACTICAL** | | | | | | |
| 7 | 22AI24701 | Computer Vision Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 8 | 22AI26703 | Internship in Industry | - | - | - | 1 | EEC |
| | | **TOTAL** | **18** | **0** | **3** | **20.5** | |

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## VIII Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | | Program Elective – 5 | 3 | 0 | 0 | 3 | PE |
| 2 | | Program Elective – 6 | 3 | 0 | 0 | 3 | PE |
| | **PRACTICAL** | | | | | | |
| 3 | 22AI36801 | Project Work | 0 | 0 | 12 | 6 | EEC |
| | | **TOTAL** | **6** | **0** | **12** | **12** | |

**TOTAL NUMBER OF CREDITS: 20+23+29+24.5+20+24+20.5+12 = 163**

## PROGRAM ELECTIVE COURSES: VERTICALS

| Vertical I Networking | Vertical II Computing Techniques | Vertical III Application Development | Vertical IV Data Analytics & Deep Learning | Vertical V Cyber Security |
|---|---|---|---|---|
| Information Storage and Management | Introduction To IOT | Open Source Software | Data Warehousing and Data Mining | Introduction To Cyber Security |
| Computer Networks | Cloud Computing | Image Processing | R Programming | Cryptography and Network Security |
| Social Network Analysis | Multi-Core Computing | Healthcare Informatics | Knowledge Engineering | Information Retrieval Techniques |
| Information Security | Distributed Computing | Block Chain Technology | Distributed Databases | Cyber Forensics |
| Software Defined Networks | Virtualization Techniques | Object Oriented Analysis and Design | Data Visualization | Fundamentals of Nano Science |
| Network Management | Game Programming | Advanced Java Programming | AI for Robotics | Total Quality Management |
| Artificial Neural Networks | Graph Theory And Applications | Software Engineering | Biometric Technologies | Swarm Intelligence |
| | Introduction To IOT | | Predictive Analysis | Introduction To Cyber Security |
| | | | Pattern Recognition | |
| | | | Social Media Analysis | |
| | | | Optimization Techniques | |
| | | | Soft Computing | |

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**NETWORKING**

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-gory |
|---|---|---|---|---|---|---|---|
| 1 | 22AI15001 | Information Storage and Management | 3 | 0 | 0 | 3 | PE |
| 2 | 22AI15002 | Computer Networks | 3 | 0 | 0 | 3 | PE |
| 3 | 22AI15003 | Social Network Analysis | 3 | 0 | 0 | 3 | PE |
| 4 | 22AI15004 | Information Security | 3 | 0 | 0 | 3 | PE |
| 5 | 22AI15005 | Software Defined Networks | 3 | 0 | 0 | 3 | PE |
| 6 | 22AI15006 | Network Management | 3 | 0 | 0 | 3 | PE |
| 7 | 22AI15007 | Artificial Neural Networks | 3 | 0 | 0 | 3 | PE |
| **COMPUTING TECHNIQUES** | | | | | | | |
| 8 | 22AI15008 | Introduction To IOT | 3 | 0 | 0 | 3 | PE |
| 9 | 22AI1509 | Cloud Computing | 3 | 0 | 0 | 3 | PE |
| 10 | 22AI15010 | Multi-Core Computing | 3 | 0 | 0 | 3 | PE |
| 11 | 22AI15011 | Distributed Computing | 3 | 0 | 0 | 3 | PE |
| 12 | 22AI15012 | Virtualization Techniques | 3 | 0 | 0 | 3 | PE |
| 13 | 22AI15013 | Game Programming | 3 | 0 | 0 | 3 | PE |
| 14 | 22AI15014 | Graph Theory And Applications | 3 | 0 | 0 | 3 | PE |
| **APPLICATION DEVELOPMENT** | | | | | | | |
| 15 | 22AI15015 | Open Source Software | 3 | 0 | 0 | 3 | PE |
| 16 | 22AI15016 | Image Processing | 3 | 0 | 0 | 3 | PE |
| 17 | 22AI15017 | Healthcare Informatics | 3 | 0 | 0 | 3 | PE |
| 18 | 22AI15018 | Block Chain Technology | 3 | 0 | 0 | 3 | PE |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 19 | 22AI15019 | Object Oriented Analysis and Design | 3 | 0 | 0 | 3 | PE |
| 20 | 22AI15020 | Advanced Java Programming | 3 | 0 | 0 | 3 | PE |
| 21 | 22AI15021 | Software Engineering | 3 | 0 | 0 | 3 | PE |
| **DATA ANALYTICS & DEPP LEARNING** | | | | | | | |
| 21 | 22AI15021 | Data Warehousing and Data Mining | 3 | 0 | 0 | 3 | PE |
| 22 | 22AI15022 | R Programming | 3 | 0 | 0 | 3 | PE |
| 23 | 22AI15023 | Knowledge Engineering | 3 | 0 | 0 | 3 | PE |
| 24 | 22AI15024 | Distributed Databases | 3 | 0 | 0 | 3 | PE |
| 25 | 22AI15025 | Data Visualization | 3 | 0 | 0 | 3 | PE |
| 26 | 22AI15026 | AI for Robotics | 3 | 0 | 0 | 3 | PE |
| 27 | 22AI15027 | Biometric Technologies | 3 | 0 | 0 | 3 | PE |
| 28 | 22AI15028 | Predictive Analysis | 3 | 0 | 0 | 3 | PE |
| 29 | 22AI15029 | Pattern Recognition | 3 | 0 | 0 | 3 | PE |
| 30 | 22AI15030 | Social Media Analysis | 3 | 0 | 0 | 3 | PE |
| 31 | 22AI15031 | Optimization Techniques | 3 | 0 | 0 | 3 | PE |
| 32 | 22AI15032 | Soft Computing | 3 | 0 | 0 | 3 | PE |
| **CYBER SECURITY** | | | | | | | |
| 33 | 22AI15033 | Introduction To Cyber Security | 3 | 0 | 0 | 3 | PE |
| 34 | 22AI15034 | Cryptography and Network Security | 3 | 0 | 0 | 3 | PE |
| 35 | 22AI15035 | Information Retrieval Techniques | 3 | 0 | 0 | 3 | PE |
| 37 | 22AI15036 | Cyber Forensics | 3 | 0 | 0 | 3 | PE |
| 38 | 22AI15038 | Fundamentals of Nano Science | 3 | 0 | 0 | 3 | PE |
| 39 | 22AI15039 | Total Quality Management | 3 | 0 | 0 | 3 | PE |
| 40 | 22AI15040 | Swarm Intelligence | 3 | 0 | 0 | 3 | PE |

## SEMESTER WISE SUMMARY

| Sl. No | Course Area | Semester wise Credits | | | | | | | | Credits Total | Credits % |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | | |
| 1 | HS | 1 | 5 | | 5 | 2 | 3 | | | **16** | **9.81** |
| 2 | BS | 8.5 | 8.5 | 4 | | | | | | **21** | **12.88** |
| 3 | ES | 10.5 | 9.5 | | | | | | | **20** | **12.26** |
| 4 | PC | | | 12 | 13.5 | 9 | 12 | 13.5 | | **60** | **36.80** |
| 5 | PE | | | | 3 | 3 | 3 | 3 | 6 | **18** | **11.04** |
| 6 | OE | | | 3 | 3 | 6 | 3 | 3 | | **18** | **11.04** |
| 7 | EEC | | | | | | 3 | 1 | 6 | **10** | **6.13** |
| 8 | MC | | | | | | | | | | **-** |
| | **Total** | **20** | **23** | **19** | **24.5** | **20** | **24** | **20.5** | **12** | **163** | **-** |

## Mandatory Non Credit Courses (MC)

| S.NO | SEMESTER | COURSE NAME |
|---|---|---|
| 1 | I | Induction Program |
| 2 | I | தமிழர் மரபு /Heritage of Tamils |
| 3 | II | தமிழரும் தொழில்நுட்பமும் / Tamils and Technology |
| 4 | III | Environmental Science |
| 5 | IV | Universal Human Values |
| 6 | V | Constitution of India |

**BoS Chairman**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulations 2022**

**I Semester**

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22MA12101 | Engineering Mathematics –I | 3 | 1 | 0 | 4 | BS |
| 2 | 22PY12101 | Engineering Physics | 3 | 0 | 0 | 3 | BS |
| 3 | 22CS13001 | Problem Solving Techniques using C | 3 | 0 | 0 | 3 | ES |
| 4 | 2EE13101 | Basics of Electrical and Electronics Engineering | 2 | 0 | 2 | 3 | ES |
| 5 | 2EE13101 | Digital Logic & Microprocessors | 3 | 0 | 0 | 3 | ES |
| 6 | | Induction Program | - | - | - | - | MC |
| 7 | | தமிழர் மரபு /Heritage of Tamils | 0 | 0 | 0 | 1 | MC |
| | **PRACTICAL** | | | | | | |
| 8 | 22PY22001 | Physics Lab | 0 | 0 | 3 | 1.5 | BS |
| 9 | 22CS23001 | Problem Solving Techniques using C | 1 | 0 | 3 | 1.5 | ES |
| | | **TOTAL** | **15** | **1** | **8** | **20** | |

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

**Syllabus**

| **Department** | **SCIENCE AND HUMANITIES** | **Programme Code** | |
|---|---|---|---|

**I Semester**

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22MA12101** | **ENGINEERING MATHEMATICS- I (Common to all Branches)** | 3 | 1 | 0 | 4 | **100** |

| | |
|---|---|
| **Objective(s)** | To enable the students to:<br>• Understand the essentials of matrices and linear algebra in a comprehensive manner.<br>• Define the geometric aspects of curvature, radius of curvature, evolutes and envelopes as application of differential calculus.<br>• Familiarize with functions of several variables, which is applied in electrical and communication branch engineering.<br>• Explain different types of second order ordinary differential equations with variable coefficients and various methods to solve the equations.<br>• Learn the double and triple integrals and give their representation as area and volum and they will have a basic understanding of Beta and Gamma functions. |
| **Outcome(s)** | At the end of the course the students will be able to:<br>• Solve the system of equations and determine rank, Eigen values, Eigen vectors and inverse of a given matrix and diagonalize symmetric matrix by orthogonal transformations.<br>• Solve physical problems using differential calculus.<br>• Evaluate maxima and minima of functions of several variables.<br>• Solve second order differential equations with variable coefficients.<br>• Evaluate multiple integrals in Cartesian co-ordinates and define Beta and Gamma functions and its properties |

| **MODULE-I** | **MATRICES** | **9+3** |
|---|---|---|

Matrix and its types; Rank of a matrix; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Cayley-Hamilton Theorem, and Diagonalization of real and symmetric matrices by Orthogonal transformation.

| **MODULE-II** | **APPLICATIONS OF DIFFERENTIAL CALCULUS** | **9+3** |
|---|---|---|

Curvature and radius of curvature in Cartesian and parametric co-ordinates – Centre of curvature – Circle of curvature – Involutes and Evolutes – Envelopes in one and two parameters – Properties – Evolute as envelope of normals.

| **MODULE-III** | **DIFFERENTIAL CALCULUS OF SEVERAL VARIABLES** | **9+3** |
|---|---|---|

Differentiation of implicit functions – Partial derivatives – Total derivative- Euler's theorem –Jacobian and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

| | | |
|---|---|---|
| **MODULE-IV** | **ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS** | **9+3** |
| Second and higher order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Legendre polynomials -Simple problems. | | |
| **MODULE -V** | **MULTIPLE INTEGRALS** | **9+3** |
| Double integrals in Cartesian coordinates – Change of order of integration – Area as double integral – Triple integral in Cartesian coordinates – Volume as triple integral. Improper integrals; Beta and Gamma functions and their properties. | | |
| | **Total hours to be taught** | **(L:45+T:15): 60** |

| **TEXT BOOKS :** | |
|---|---|
| 1 | Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2018.. |
| 2 | B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017. |
| **REFERENCES:** | |
| 1 | G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002. |
| 2 | Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2016. |
| 3 | Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2016. |
| 4. | N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Ninth Edition,2014. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | 1 | - | - | - | - | 2 | 0 | 2 | 3 | - | - | - |
| **CO2** | 3 | 3 | 1 | 1 | - | - | - | - | 2 | 0 | 2 | 3 | - | - | - |
| **CO3** | 3 | 3 | 1 | 1 | - | - | - | - | 2 | 0 | 2 | 3 | - | - | - |
| **CO4** | 3 | 3 | 1 | 1 | - | - | - | - | 2 | 0 | 2 | 3 | - | - | - |
| **CO5** | 3 | 3 | 1 | 1 | - | - | - | - | 2 | 0 | 2 | 3 | - | - | - |
| **Average** | 3 | 3 | 1 | 1 | - | - | - | - | 2 | 0 | 2 | 3 | - | - | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous)-Syllabus | | | | | | R 2019 |
|---|---|---|---|---|---|---|
| DEPARTMENT: | SCIENCE & HUMANITIES | | Programme Code & Name | | | APPLIED PHYSICS |
| **SEMESTER-I (For Circuit Branches)**<br>**SEMESTER-II (For Non-Circuit Branches)** | | | | | | |
| **COURSE CODE** | **COURSE NAME** | **HOURS/WEEK** | | | **CREDIT** | **MAXIMUM MARKS** |
| | | **L** | **T** | **P** | **C** | |
| **22PY12001** | **ENGINEERING PHYSICS (FOR ALL BRANCHES)** | 3 | 0 | 0 | 3 | **100** |

| | |
|---|---|
| **Objective(s)** | • To provide students with a fundamental knowledge of physics, together with problem-solving skills, and an understanding of principles of physics, lasers, structure of solids, properties of matter, ultrasonic and fiber optics. |
| **Outcome(s)** | After completing the course the students:<br>• Acquire knowledge on basics of Laser and its applications in various fields.<br>• Explain the basics of crystals, their structures and different crystal growth techniques<br>• Have the necessary understanding on Properties of materials and their uses.<br>• Gain knowledge about Ultrasonic's and their applications in engineering fields.<br>• Analyze the basics of fiber optics and its types of material and their applications. |

| **UNIT-I** | **LASER AND ITS APPLICATIONS** | (9 Hrs) |
|---|---|---|

Introduction – Principle of spontaneous emission, stimulated absorption and emission – Einstein's coefficient (derivation) – Types of lasers - $CO_2$, Nd: YAG, semiconductor laser –homo junction and hetro junction laser– Applications: Lasers in welding, cutting, drilling and soldering - medical applications: laser endoscopy- Holography: Construction and reconstruction of hologram – applications.

| **UNIT-II** | **STRUCTURE OF SOLIDS** | (9 Hrs) |
|---|---|---|

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures, Polymorphism and allotropy ,Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques qualitative)

| **UNIT-III** | **PROPERTIES OF MATTER** | (9 Hrs) |
|---|---|---|

Elasticity – Stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength – torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

| UNIT-IV | ULTRASONICS AND APPLICATIONS | (9 Hrs) |
|---|---|---|
| Introduction – Production – magnetostriction effect - magnetostriction generator – piezoelectric and inverse piezoelectric effect- piezoelectric generator – properties – Cavitations - Velocity measurement – acoustic grating - Industrial applications –drilling, welding, soldering and cleaning – SONAR - Non Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays. | | |
| **UNIT-V** | **FIBER OPTICS** | (9 Hrs) |
| Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, and mode) – losses associated with optical fibers - fibre optic sensors: pressure and displacement- photo current in a P-N diode – Solar cell - LED –Laser diodes – Optical data storage techniques. | | |
| | Total hours to be taught | (45 Hrs) |

| **Text books :** | |
|---|---|
| 1. | Dr. Palanisamy P.K, "Engineering Physics", Scitech Publications, Chennai, 2010. |
| 2. | A.S.Vasudeva-Modern Engineering Physics-S.Chand & Co, New Delhi-1998- Second edition 2003. |
| 3. | Wahab, M.A. ―Solid State Physics: Structure and Properties of Materials. Narosa Publishing House, 2009 |
| **REFERENCES** | |
| 1. | Pillai S O, "Engineering Physics", New Age International Publishers, New Delhi, 2005. |
| 2. | Satyaprakash-Engineering Physics-Pragati Prakashan,Meerut-I Edition 2003 |
| 3. | Dr.M.Arumugam-Engineering Physics - Anuradha Agencies, Kumbakonam-III Revised Edition 2002. |
| 4. | D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | 3 | 3 | 2 | - | - | - | - | 1 | - | 3 | - | - | - |
| **CO2** | 3 | | 3 | 3 | 2 | - | - | - | - | 1 | - | 3 | - | - | - |
| **CO3** | 3 | 3 | 2 | 3 | - | - | - | - | - | 1 | - | 3 | - | - | - |
| **CO4** | 3 | 2 | 2 | 3 | - | - | - | - | - | 1 | - | 3 | - | - | - |
| **CO5** | 3 | 2 | 3 | 3 | - | - | - | - | - | 1 | - | 3 | - | - | - |
| **Average** | 3 | 2.3 | 2.6 | 3 | 2 | - | - | - | - | 1 | - | 3 | - | - | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus-R2019** | | | | | | |
| **Department** | **Electrical and Electronics Engineering** | | | **Programme Code** | | **1051** |
| **I Semester** | | | | | | |
| **Course Code** | **Course name** | **Hours/week** | | | **Credit** | **Maximum Marks** |
| | | **L** | **T** | **P** | **C** | |
| **22EE13101** | **BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING** | **3** | **0** | **0** | **3** | **100** |
| Objective(s) | To impart knowledge on<br>1. Electric basic circuit laws and three phase circuits<br>2. Principle of Electrical Machines and Various Measuring Instruments<br>3. Semiconductor Devices and Communication Systems | | | | | |
| Outcome(s) | Ability to<br>1. Analyze electric circuits<br>2. Explain the working principles of electrical machines<br>3. Choose appropriate instruments for electrical measurement for a specific application<br>4. Apply the concepts of various electronic devices to perform simple applications.<br>5. Apply the concept of communication systems. | | | | | |
| **UNIT I** | **ELECTRICAL CIRCUITS** | | | | | **(9)** |
| Ohms Law – Kirchhoff's Law-Steady state solution of DC circuits – introduction to AC circuits – waveforms and RMS value – Power and power factor- Introduction to Three phase circuits-Three phase Power measurement. | | | | | | |
| **UNIT II** | **ELECTRICAL MACHINES** | | | | | **(9)** |
| Construction and Principle of operation DC machines - applications - Construction and Principle of single phase transformers, Induction motor – Three phase squirrel cage induction motor - Single phase induction motor - Applications | | | | | | |
| **UNIT III** | **MEASUREMENTS AND INSTRUMENTATION** | | | | | **(9)** |
| Classification of instruments – moving coil and moving iron meters – Induction type, dynamometer type wattmeter's – Energy meter – Megger – Instrument transformers (CT & PT) – Wheatstone's bridge, Maxwell's bridge and Schering Bridge (Qualitative Treatment only). | | | | | | |
| **UNIT IV** | **SEMICONDUCTOR DEVICES AND APPLICATIONS** | | | | | **(9)** |
| Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor –Common Emitter Configurations and its VI Characteristics. | | | | | | |
| **UNIT V** | **COMMUNICATION SYSTEMS** | | | | | **(9)** |
| Analog and Digital Signals – Modulation and Demodulation - Principles of Amplitude and Frequency Modulations (Qualitative Treatment). Communication Systems: TV, Satellite and Optical Fibre communication (Block Diagram Approach only). | | | | | | |
| | Total Hours | **L:45 T:0(45 Hours )** | | | | |
| | | | | | | |

| TEXT BOOKS | |
|---|---|
| 1. | V.K Mehta and Rohit Mehta, 'Principle of Electrical Engineering' S Chand & Company, 2008. |
| 2. | S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 2008. |
| 3. | David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008. |
| **REFERENCES** | |
| 1. | Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, 2006. |
| 2. | William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition, 2002. |
| 3. | J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2nd Edition, 2008. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | - | 3 | 3 | 2 | - | - | - | - | 1 | - | 3 | 3 | 3 | - |
| **CO2** | 3 | - | 3 | 3 | 2 | - | - | - | - | 1 | - | 2 | 3 | 3 | - |
| **CO3** | 2 | 3 | 2 | 3 | - | - | - | - | - | 2 | - | 2 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | 3 | 1 | - | - | - | - | 1 | - | 3 | 3 | 2 | - |
| **CO5** | 3 | 2 | 3 | 3 | - | - | - | - | - | 1 | - | 3 | 3 | 3 | - |
| **Average** | **2.6** | **1.8** | **2.6** | **3** | **1** | **-** | **-** | **-** | **-** | **1.2** | **-** | **2.6** | **2.6** | **2.6** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Computer Science and Engineering | Programme Code | 1031 |
|---|---|---|---|

**B.Tech – Artificial Intelligence And Data Science**

**I Semester**

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22CS13001 | PROBLEM SOLVING TECHNIQUES IN C (Common to All Branches) | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• To understand the basics of algorithmic problem solving<br>• Understand the basic concepts of C Programming.<br>• Learn the arrays and functions in C<br>• Be familiar with pointers and structures in C<br>• Understand the file handling techniques and preprocessors in C |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Develop Algorithms for real time problems through various Problem solving techniques<br>• Define the syntax of C Programming<br>• Summarize the use of functions and pointers in programming in C programming concepts<br>• Apply the concepts of pointers and structure<br>• Describe the fundamental concepts of files and preprocessors in C |

| | | |
|---|---|---|
| **UNIT-I** | **PROBLEM SOLVING ASPECTS** | **9** |

Problem Solving Aspects: Algorithms Pseudo code, Flowchart- Steps In Problem Solving-simple strategies for developing algorithms (iteration, recursion)- Programming methodologies - Illustrative problems: Exchanging The Values-Counting-Find minimum in a list - Factorial Computation - Fibonacci Sequence.

| | | |
|---|---|---|
| **UNIT-II** | **C PROGRAMMING BASICS** | **9** |

Introduction to C programming – Header files – Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions – operators – Input and Output operations – Decision Making and Branching – Looping statements- Programming Examples

| | | |
|---|---|---|
| **UNIT-III** | **ARRAYS AND FUNCTIONS** | **9** |

Arrays: Introduction –One-Dimensional Arrays-Two-Dimensional Arrays -Multidimensional Arrays - Strings: Operations of Strings. Function – definition of function – Declaration of function – Function prototype – Types of functions – Pass by value – Pass by reference – Recursion - Programming Examples

| | | |
|---|---|---|
| **UNIT-IV** | **POINTERS AND STRUCTURES** | **9** |

Pointers - Definition – Initialization - Pointers and arrays- Introduction to Structure – structure definition – Structure declaration – Structure within a structure- Unions – Storage classes

| | | |
|---|---|---|
| **UNIT-V** | **FILE PROCESSING AND PREPROCESSORS** | **9** |

| | |
|---|---|
| Files: File modes- File functions-File operations-Text and Binary files, Command Line arguments- C Preprocessor directives: Macros – Definition- types of Macros- Creating and implementing user defined header files. | |
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOK :** | |
| 1 | Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India)Pvt. Ltd. Pearson Education, 2016. |
| **REFERENCES:** | |
| 1 | Dromey R.G, "How to Solve it by Computer" Prentice Hall of India, Delhi., 2010. |
| 2 | E Balagurusamy, "Computer Programming", First Edition, Tata McGraw Hill Education (India ) Private Ltd, New Delhi., 2013. |
| 3 | Pradip Dey, Manas Ghosh, " Computer Fundamentals and Programming in C", 2nd Edition, Oxford University Press.,2013. |
| 4 | M.Rajaram and P.Uma Maheshwari " Computer Programming with C", Pearson Education., 2013. |
| 5 | NPTEL course, Problem Solving Through Programming in C, https://nptel.ac.in/courses/106105171 |
| 6 | NPTEL course, Introduction to Programming in C, https://nptel.ac.in/courses/106104128 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 3 | 3 | - |
| **CO2** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 3 | - | - |
| **CO3** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 3 | 2 | - |
| **CO4** | 2 | 2 | - | 2 | 2 | - | - | - | - | - | 1 | 1 | 3 | - | - |
| **CO5** | 1 | 2 | - | - | 1 | - | - | - | - | - | 1 | - | 2 | 2 | - |
| **Average** | **2.4** | **2.6** | **1.8** | **1.8** | **1.8** | **-** | **-** | **-** | **-** | **-** | **1.6** | **1** | **2.8** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Computer Science and Engineering | Programme Code | 1031 |
|---|---|---|---|

**B.Tech – Artificial Intelligence And Data Science**

**I Semester**

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22CS13101 | DIGITAL LOGIC & MICROPROCESSORS | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• To know about various number systems and logic gates<br>• To understand the basic concepts of boolean functions and their simplifications<br>• To learn the basics of combinational circuits and their various components<br>• To be familiar the basics of sequential circuits and their various components<br>• To understand the architecture of 8086 microprocessor |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Explain the conversion of number systems from one form to another and logic gates<br>• Describe boolean functions and their simplification techniques<br>• Summarize the components comes under combinational circuits and their the use of functions and pointers in programming in C programming concepts<br>• Apply the concepts of pointers and structure<br>• Describe the fundamental concepts of files in C |

| | | |
|---|---|---|
| **UNIT-I** | **DIGITAL FUNDAMENTALS** | **9** |
| Review of Number Systems – Number conversion - Arithmetic Operations – Binary Codes – Logic Gates – NAND and NOR Implementations | | |
| **UNIT-II** | **BOOLEAN FUNCTIONS** | **9** |
| Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions - Karnaugh Map - Tabulation Method | | |
| **UNIT-III** | **COMBINATIONAL CIRCUITS** | **9** |
| Introduction to Combinational Circuits – Half adder – Full adder – Half Subtractor – Full Subtractor – Decoder – Encoder – Multiplexer - Demultiplexer | | |
| **UNIT-IV** | **SEQUENTIAL CIRCUITS** | **9** |
| Introduction to Sequential Circuits - Flip Flops – Types of Flip flops – Shift registers – Counters: 4-bit binary synchronous and asynchronous counters | | |
| **UNIT-V** | **8086 MICROPROCESSOR ARCHITECTURE** | **9** |
| Introduction to Microprocessor – 8086 Pin diagram - CPU architecture – Addressing modes – Instruction formats – Data transfer instructions – Arithmetic instructions – Logical instructions – Branch and loop instructions – Interrupts | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOK :** | |
| 1 | M. Morris Mano, Michael D Ciletti, "Digital Design", Global Edition, Pearson Education Ltd, 2019. |
| 2 | Barry B.Brey, "The Intel Microprocessors – Architecture, Programming, and Interfacing", Pearson Prentic Hall, 2009. |
| **REFERENCES:** | |
| 1 | John F.Wakerly, "Digital Design Principles and Practices", Fourth Edition, Pearson Education, 2007. |
| 2 | Kharate G. K., "Digital Electronics", Oxford University Press, 2010. |
| 3 | Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011 |
| 4 | Nptel course, Digital Logic Design, https://onlinecourses.nptel.ac.in/noc22_ee45/preview |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | 2 | 3 | 3 | - |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | 2 | 2 | 2 | - |
| **CO3** | 3 | 3 | 2 | 3 | 2 | 2 | - | - | - | - | 1 | - | 1 | 2 | - |
| **CO4** | 3 | 3 | 2 | 2 | 3 | 1 | - | - | - | - | 1 | 1 | 2 | 2 | - |
| **CO5** | 3 | 2 | 2 | 2 | 3 | 2 | - | - | - | - | 1 | - | 2 | 2 | - |
| **Average** | **3** | **3** | **2** | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **1** | **1** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous)-Syllabus | | | | | | R 2019 |
|---|---|---|---|---|---|---|
| DEPARTMENT: | SCIENCE & HUMANITIES | | Programme Code & Name | | | PHYSICS LABORATORY |
| **SEMESTER-I (For Circuit Branches)**<br>**SEMESTER-II (For Non-Circuit Branches)** | | | | | | |
| **COURSE CODE** | **COURSE NAME** | **HOURS/WEEK** | | | **CREDIT** | **MAXIMUM MARKS** |
| **22PY22001** | **PHYSICS LABORATORY (FOR ALL BRANCHES)** | **L** | **T** | **P** | **C** | **100** |
| | | 0 | 0 | 3 | 1.5 | |
| **Objective(s)** | • To provide exposure to the students with hands on experience on various basic applied physics practices for all branches. | | | | | |
| **OUTCOMES** | • The hands on exercises undergone by the students will help them to apply physics<br>• Principles of optics and thermal physics to evaluate engineering properties of materials. | | | | | |

1. a) Determination of Wavelength, and particle size using Laser
   (b)Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
3. Air Wedge – Thickness of a Wire
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of Young's modulus by Non uniform bending method
6. Determination of Band Gap of a semiconductor material.
7. Determination of viscosity of liquid – Poiseuille;s method
8. Determination of Young's modulus by Uniform bending method
9. Torsional Pendulum – Determination of Rigidity modulus 10.
10. Spectrometer dispersive power of a prism

(Choose ANY 7 Experiments)

| **REFERENCES** | |
|---|---|
| 1. | Physics Laboratory Manual, Department of Physics, Mahendra Engineering College, Namakkal |
| 2 | Geeta Sanon, B.Sc Practical Physics, 1st Edn. (2007), R. Chand & Co. |
| 3 | B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi. |
| 4 | Indu Prakash and Ramakrishna, A Text Book of Practical Physics, Kitab Mahal, New Delhi. |
| 5 | D. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | - | - | - | - | - | - | 2 | 1 | 3 | 1 | 3 | 2 | - |
| **CO2** | 3 | 3 | - | - | - | - | - | - | 2 | 1 | 2 | 2 | 3 | 2 | - |
| **CO3** | 3 | 3 | - | - | - | - | - | - | 2 | 1 | 2 | 1 | 3 | 3 | - |
| **Average** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | **1** | **3** | **1** | **3** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE

**(Autonomous)**

## Syllabus

| Department | Computer Science and Engineering | Programme Code | 1031 |
|---|---|---|---|

**B.Tech – Artificial Intelligence & Data Science**

**I Semester**

| Course Code | Course Name | Hours/Week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22CS23001 | PROBLEM SOLVING TECHNIQUES USING C LAB (I Semester for all circuit branches and II Semester for all non-circuit branches) | 0 | 0 | 3 | 1.5 | 100 |

**Objectives**

**The student should be made to:**

- Understand interfacing components of PC Motherboard.
- Expertise in developing applications using Office Packages.
- Formulate problems and implement algorithms using Raptor tool.
- Make use of loops and functions in C.
- Understand different types of statements, structures, unions and files.

**Outcomes**

**Upon completion of the course, the students should be able to:**

- Identify the interfacing components of PC
- Demonstrate the applications of Office Packages
- Obtain solutions for the real world problems using Raptor Tool and
- Develop programs using decision making statements, loops and functions
- Apply structures, unions and files various types of statements for problem solving in C

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1 | Study and Identification of PC Motherboard and its Interfacing Components - https://www.youtube.com/watch?v=b2pd3Y6aBag |
| 2 | Prepare a Bio-data using Word Processor with Appropriate age, text and Table formatting options and send the same to recipients using Mail Merge |
| 3 | Create budget planning of your family with cell referencing, formulae, conditional formatting using Excel |
| 4 | Create a program flow to illustrate the use of Variables and Constants using Scratch Tool |
| 5 | Construct flowchart to find the Factorial for a given number using Raptor |
| 6 | Students mark generation using decision statements |
| 7 | Calculator using switch statement |
| 8 | Prime number generation and to check whether the number is Armstrong or not using looping |
| 9 | Greatest number using array (one dimensional) |

| | | |
|---|---|---|
| 10 | Matrix addition / multiplication using array (two dimensional) | |
| 11 | String functions | |
| 12 | Factorial calculation and fibonacci series using function | |
| 13 | Student mark sheet using structures | |
| 14 | Copy text from one file to other file | |
| | **TOTAL HOURS** | **30** |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | - | 2 | 2 | - | - | 2 | 1 | - | - | 2 | 3 | 2 | - |
| **CO2** | 3 | 3 | - | 2 | 2 | - | - | 2 | 1 | - | - | 3 | 3 | 2 | - |
| **CO3** | 3 | 3 | - | 2 | 2 | - | - | 2 | 1 | - | - | 3 | 3 | 3 | - |
| **Average** | **3** | **3** | **-** | **2** | **2** | **-** | **-** | **2** | **1** | **-** | **-** | **2.6** | **3** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-'- No Correlation**

# MAHENDRA ENGINEERING COLLEGE

(Autonomous)

Accredited by NAAC 'A' Grade & NBA Tier-I (WA) UG: CSE,ECE,EEE

Mahendhirapuri, Mallasamudram, Namakkal Dt. - 637 503.

**Regulations 2022**

**Batch 2022-2023 - II Semester**

**Batch 2023-2024 onwards - I Semester**

(Common to all B.E./B.Tech. Programmes)

| Course Code | Course Name | Periods/Week | | | Credit | Maximum Marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22HS11001 | தமிழர் மரபு | 1 | 0 | 0 | 1 | 100 |

| | | |
|---|---|---|
| அலகு 1 | மொழி மற்றும் இலக்கியம் | 3 |

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்வியக்கங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலங்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

| | | |
|---|---|---|
| அலகு 2 | மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை | 3 |

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

| | | |
|---|---|---|
| அலகு 3 | நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் | 3 |

தெருக்கூத்து கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

| | | |
|---|---|---|
| அலகு 4 | தமிழர்களின் திணைக் கோட்பாடுகள் | 3 |

தமிழகத்தின் தாவரங்களும் விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும் கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

| | | |
|---|---|---|
| அலகு 5 | இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு | 3 |

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

**TOTAL – 15 PERIODS**

| TEXT BOOK AND REFERENCE BOOKS | |
|---|---|
| 1. | தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை ( வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்) |
| 2. | கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்) |
| 3. | கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் ( தொல்லியல் துறை வெளியீடு) |
| 4. | பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு) |
| 5. | Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print) |
| 6. | Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies. |
| 7. | Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies). |
| 8. | The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.) |
| 9. | Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) |
| 10. | Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) |
| 11. | Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) |
| 12. | Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book. |

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulations 2022**

## II Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22MA12102 | Engineering Mathematics –II | 3 | 1 | 0 | 4 | BS |
| 2 | 22CY12001 | Chemistry for Engineering | 3 | 0 | 0 | 3 | BS |
| 3 | 22EN11001 | Communicative English | 3 | 0 | 0 | 3 | HS |
| 4 | 22GE13001 | Engineering Graphics and Design | 3 | 0 | 2 | 4 | ES |
| 5 | 22CS13201 | Data Structures | 4 | 0 | 0 | 4 | ES |
| 6 | | தமிழரும் தொழில்நுட்பமும் / Tamils and Technology | 0 | 0 | 0 | 1 | MC |
| | **PRACTICAL** | | | | | | |
| 7 | 22CY22001 | Chemistry Laboratory | 0 | 0 | 3 | 1.5 | BS |
| 8 | 22CS23201 | Data Structures Laboratory | 0 | 0 | 3 | 1.5 | ES |
| 9 | 22EN21001 | Personality Development Practice Lab | 1 | 0 | 2 | 1 | HS |
| | | **TOTAL** | **17** | **1** | **10** | **23** | |

# MAHENDRA ENGINEERING COLLEGE
# (Autonomous)

## Syllabus

| Department | SCIENCE AND HUMANITIES | Programme Code | |
|---|---|---|---|

## II Semester

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22MA12201 | ENGINEERING MATHEMATICS - II (Common to all Branches) | 3 | 1 | 0 | 4 | 100 |

| | |
|---|---|
| **Objective(s)** | To enable the students to:<br>• Define vector function, operators and working procedure to evaluate line , surface and volume integrals.<br>• Learn Laplace transform, inverse Laplace transform and its properties to solve differential equations.<br>• Understand Fourier transforms, inverse Fourier transform and its properties and apply convolution theorem and Parseval's identity to various functions<br>• Know about functions of a complex variable, properties and problems involving conformal mapping.<br>• Learn about Taylor's and Laurent's series expansion of complex functions and the process of evaluating complex integrals. |
| **Outcome(s)** | At the end of the course the students will be able to:<br>• Understand the fundamental and basic concepts in ordinary differential equations to solve problems related to engineering applications.<br>• Acquire sound knowledge of Laplace transform and its properties inverse Laplace transform and the solution of linear differential equation using Laplace transform techniques.<br>• Learn about Fourier transforms , inverse Fourier transform and its properties and apply convolution theorem and Parseval's identity to various functions<br>• Gain knowledge of analytic functions and its properties , conformal mapping and its applications.<br>• Expand the functions as Taylor's and Laurent's series and evaluate the complex integrals. |

| **MODULE-I** | **VECTOR CALCULUS** | **9+3** |
|---|---|---|

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

| **MODULE -II** | **LAPLACE TRANSFORM** | **9+3** |
|---|---|---|

Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem, solving ODEs by Laplace Transform method.

| **MODULE-III** | **FOURIER TRANSFORMS** | **9+3** |
|---|---|---|

Fourier integral theorem (statement only)-Fourier transform pair (infinite) - Sine and cosine transforms-Properties-Transform of simple functions-Convolution theorem-Parseval's idendity.

| MODULE-IV | COMPLEX VARIABLE – DIFFERENTIATION | 9+3 |
|---|---|---|
| Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. | | |
| **MODULE -V** | **COMPLEX VARIABLE – INTEGRATION** | **9+3** |
| Contour integrals, Cauchy Integral theorem and Cauchy Integral formula (without proof), Taylor's series, Laurent's series; zeros of analytic functions, singularities,; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral over unit circle. | | |
| | **Total hours to be taught** | **(L:45+T:15): 60** |

| **TEXT BOOK :** | |
|---|---|
| 1 | Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2018. |
| 2 | B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017. |
| **REFERENCES:** | |
| 1 | V. Krishnamurthy, V. P. Mainra and J. L. Arora, " An introduction to Linear Algebra" , Affiliated East-West press, 2005. |
| 2 | Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2016. |
| 3 | Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010. |
| 4. | N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Ninth Edition,2014. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 1 | - | - | - | - | - | 2 | - | 2 | 3 | - | - | - |
| **CO2** | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 2 | 3 | - | - | - |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 2 | 3 | - | - | - |
| **CO4** | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 2 | 3 | - | - | - |
| **CO5** | 3 | 3 | 1 | - | - | - | - | - | 2 | - | 2 | 3 | - | - | - |
| **Average** | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 2 | 3 | - | - | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
# (Autonomous)

## Syllabus

| Department | SCIENCE AND HUMANITIES | Programme Code | |
|---|---|---|---|

## II Semester

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22CY12001 | ENGINEERING CHEMISTRY | 3 | 0 | 0 | 3 | 100 |

**Objective(s)**

To make the students familiar with :

- The treatment of water for domestic and industrial purposes.
- The identification of various types of polymers in our surrounding.
- The concepts of photochemistry and spectroscopy principles and their applications
- The basic principles and preparatory methods of nanomaterials.
- The principles of electrochemistry, electrochemical cells, emf and applications of emf measurements.

**Outcome(s)**

At the end of the course, the student will be able to :

- Understand the basic principles of water quality parameters, their analysis and various water treatment processes for domestic and industrial applications.
- Recognize the kinetics of polymerization and uses of polymers
- Identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.
- Understand and apply basic concepts of nano science and nanotechnology in designing the synthesis of nano materials for engineering and technology applications.
- Know the basic principles of electrochemistry and its applications.

### UNIT - I WATER TECHNOLOGY — 9 Hrs

Characteristics – alkalinity – types of alkalinity and determination – hardness – types and estimation by EDTA method ; Domestic water treatment – disinfection methods (Chlorination, ozonation. UV treatment) – Boiler feed water – requirements –Formation of deposits in steam boilers and heat exchangers - disadvantages wastages of fuels, decreased inefficiency and boiler explosion of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – demineralization process– desalination and reverse osmosis.

### UNIT - II POLYMER CHEMISTRY — 9 Hrs

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types of polymerization - Addition, condensation and copolymerization. Free radical polymerization mechanism - Properties of polymers: Tg, Molecular weight – weight average, number average and polydispersity index. Preparation, properties and uses of Bakelite, PE, PVC, nylon and Teflon. –Polymer matrix composite – FRP.

### UNIT - III PHOTOCHEMISTRY AND SPECTROSCOPY — 9 Hrs

**Photochemistry:** Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert- Beer Law (derivation only). Photo physical processes - Jablonski diagram. **Spectroscopy:** Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR

| | | |
|---|---|---|
| spectroscopy – principles, instrumentation (Block diagram only) and application. | | |
| **UNIT - IV** | **NANOCHEMISTRY** | 9 Hrs |
| Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles-nano cluster, nano rod, nanotube (CNT) and nanowire. Synthesis-precipitation, hydrothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and applications (medicine, agriculture and electronics). | | |
| **UNIT - V** | **ELECTROCHEMISTRY** | 9 Hrs |
| Electrolytic cell - Electrochemical cells –EMF –measurement of emf –Single electrode potential – electrochemical series –significance –Nernst equation (derivation only) –reference electrodes –Standard Hydrogen electrode - Calomel electrode –Ion selective electrode –glass electrode and measurement of pH. – potentiometer titrations (redox – $Fe^{2+}$ vs dichromate and precipitation – $Ag^{+}$ vs $CI^{-}$ titrations) and conduct metric titrations (acid-base – HCI vs, NaOH) titrations. | | |
| Total hours to be taught | **(L:45+T:15): 60** | |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2010 |
| 2 | Dr.C.K.Charles and Dr.G.Ramachandran, "Applied Chemistry", CARS Publishers,Chennai,2015 |
| **REFERENCES:** | |
| 1 | Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010 |
| 2 | Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008. |
| 3 | Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | 1 | - | - | 1 | - | - | - | - | 1 | - | - | - |
| **CO2** | 2 | - | - | 1 | - | - | 1 | - | - | - | - | 1 | - | - | - |
| **CO3** | 3 | - | - | 1 | - | - | - | - | - | - | - | 1 | - | - | - |
| **CO4** | 3 | - | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - |
| **CO5** | 3 | - | - | 1 | - | - | 1 | - | - | - | - | 1 | - | - | - |
| **Average** | **2.6** | - | - | **1** | - | - | **1** | - | - | - | - | **1** | - | - | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
# (Autonomous)

## Syllabus

| Department | Mechanical Engineering | Programme Code | |
|---|---|---|---|

## II Semester

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22GE13001 | ENGINEERING GRAPHICS and DESIGN (Integrated Course) | 3 | 0 | 2 | 4 | 100 |

**Objective(s)**

- Increase ability to communicate with people through drawing skills as per the BIS standard.
- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic Auto Cad skills.
- Learn basic Engineering Drawing formats.

**Outcome(s)**

- Students ability to indicate proper dimensions on drawings will improve
- Students ability to perform basic sketching techniques will improve.
- Students will become familiar with office practice and standards.
- Students will become familiar with Auto Cad two dimensional drawings.
- Students will be able to improve their visualization skills so that they can apply these skills in developing new products.

**Examination Pattern: Theoretical Mode**

**UNIT - I** **Plane Curves and Free Hand Sketching** 9 Hrs

**Curves used in engineering practices:**

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.

**Free hand sketching:**

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

**UNIT - II** **Projection of Points, Lines and Plane Surfaces** 9 Hrs

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

**Examination Pattern: Practical Mode**

| | | |
|---|---|---|
| **UNIT - III** | **Projection of Solids** | 9 Hrs |
| Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method. | | |
| **UNIT - IV** | **Section of Solids and Development of Surfaces** | 9 Hrs |
| Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones –Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis. | | |
| **UNIT - V** | **Isometric and Perspective Projections** | 9 Hrs |
| Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Perspective projection of prisms, pyramids and cylinders by visual ray method. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **LIST OF EQUIPMENTS** (for a batch of 30 students) | |
| **List of Equipments:**<br>1. Better hardware, with<br>suitable graphics facility -30 No<br>2. Licensed software for Drafting and Modeling. - 30 Licenses<br>3. Laser Printer or Plotter to print / plot drawings - 1 No | |
| **TEXT BOOKS:** | |
| 1. | N S Parthasarathy and Vela Murali, "Engineering Drawing" Oxford University Press 2015. |
| 2. | K. Venugopal & V. Prabhu Raja, "Engineering Graphics", New Age International (P) Limited, 2011 |
| 3. | K. V. Natrajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2012 |
| 4. | M.S. Kumar, "Engineering Graphics", D.D. Publications, 2010. |
| **REFERENCES:** | |
| 1. | M.B. Shah and B.C. Rana, "Engineering Drawing", Pearson Education 2005. |
| 2. | K. R. Gopalakrishnana, "Engineering Drawing" (Vol.I&II), Subhas Publications 1998. |
| 3. | Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008. |
| 4. | Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited 2008. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | - | - | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| **CO2** | 3 | - | - | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| **CO3** | 3 | - | - | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| **CO4** | 3 | - | - | - | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| **CO5** | 3 | - | - | 1 | - | - | - | - | - | - | - | 1 | 2 | 2 | - |
| **Average** | **3** | - | - | **1** | - | - | - | - | - | - | - | **1** | **2** | **2** | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**SYLLABUS - REGULATION - 2022**

**SEMESTER – I (Non-Circuit Branches & ECE)** **SEMESTER- II (Circuit Branches except ECE)**

| Course Code | Course Name | Hours / Week | | | Credit | Maximum Marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22EN11001(R) | **COMMUNICATIVE ENGLISH** (Common to all B.E/B.Tech Degree Programmes) | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objectives** | • To help learners to improve their knowledge of grammar<br>• To enable them to use vocabulary appropriately in different academic and professional contexts<br>• To support learners to acquire listening and speaking skills<br>• To facilitate them to develop their reading skills by familiarizing different types of reading strategies<br>• To equip them with writing skills needed for academic as well as professional context |
| **Outcomes** | At the end of the course, the learners will be able to<br>• Develop listening and reading skills and comprehend the academic articles in English<br>• Develop vocabulary skills and use words appropriately in different academic contexts.<br>• Analyze and interpret the data with correct usage of grammar<br>• Demonstrate effective LSRW skills with emerging technology<br>• Create strong communication skills in both personal and professional life |

| **UNIT I** | **9 Hrs** |
|---|---|
| **Listening**- Listening to Short Conversations (Formal and Informal)<br>**Speaking** – Introducing Oneself and Others<br>**Reading** – Skimming and Scanning-Reading Comprehension Passages and Answering Multiple Choice Questions<br>**Writing** - Leave/On Duty application, Bonafide Certificate-requisition, Check list, Instructions<br>**Grammar & Vocabulary** – Parts of Speech, Articles, Prefixes and Suffixes | |
| **UNIT II** | **9 Hrs** |
| **Listening** – Listening to Telephonic Conversations<br>**Speaking** –Greetings and Welcome Address<br>**Reading** – Predicting the Content of a Given Article – Newspaper Articles<br>**Writing**- Recommendations, Composing E-Mail(Formal & Informal), Letter Writing- Invitation letter<br>**Grammar & Vocabulary** – Sentence Pattern, Tenses, British Terms and American Equivalents, | |
| **UNIT III** | **9 Hrs** |
| **Listening** - Listening to Talks and Note taking<br>**Speaking** – Role Play<br>**Reading** –Cloze Reading and Fill up the Gaps | |

| | |
|---|---|
| **Writing** - Letter Writing – Permission Letter (In-Plant Training/Industrial Visit), Business letters- Calling for Quotation and Placing Order<br>**Grammar & Vocabulary** –If Conditionals, Abbreviations and Acronyms | |
| **UNIT IV** | **9 Hrs** |
| **Listening** - Listening to Audio Lectures<br>**Speaking** – Talking part in Casual Conversation<br>**Reading** - Reading Advertisements<br>**Writing** – Poster Making, and Job Application<br>**Grammar & Vocabulary** – Concord, Gerunds and Infinitives, Synonyms and Antonyms | |
| **UNIT V** | **9 Hrs** |
| **Listening** – Listening to Academic lectures<br>**Speaking** - Describing Objects<br>**Reading** – Transcoding (Conversion of Flow Chart, Bar chart, Pie chart into a paragraph)<br>**Writing** –Review writing (Films & Books), Essay Writing,<br>**Grammar & Vocabulary** – Modal Verbs, Voice- Active Voice, Passive Voice and Impersonal Passive, Question tags and Nominal Compounds | |
| **Total Hours** | **45** |

| | |
|---|---|
| **Textbook:** | |
| 1 | Murphy, Raymond, *English Grammar in Use*, Fifth Edition. Cambridge University Press, New Delhi, 2019 |
| 2 | N.P.Sudharshana and C.Savitha, *English For Technical Communication*, Cambridge University Press, New Delhi, 2016 |
| **Reference Books:** | |
| 1 | Lewis Norman, *Word Power Made Easy*, Goyal Publishers: New Delhi. 2020. |
| 2 | Ashraf Rizvi. *Effective Technical Communication*, Tata McGraw Hill, 2017. |
| 3 | Jack C. Richards with Jonathan Hull and Susan Proctor, *Interchange*. 4th Edition, Cambridge University Press, New Delhi, 2016 |
| **Extensive Reading:** | |
| 1 | Khera, Shiv. *You can Win*. Macmillan, Delhi. 1998 |
| **Websites:** | |
| 1 | http://www.englishclub.com |
| 2 | http://www.talkenglish.com |
| 3 | https:// www.ted.com/talks |
| 4 | https://nptel.ac.in/ |

* Listening and Speaking will be tested internally

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | - | - | - | - | - | - | 2 | - | 2 | 3 | 3 | - |
| **CO2** | 2 | - | - | - | - | - | - | - | - | 2 | - | 2 | 3 | 3 | - |
| **CO3** | 2 | - | - | - | - | - | - | - | - | 3 | - | 2 | 2 | 2 | - |
| **CO4** | 2 | - | - | - | - | - | - | - | - | 2 | - | 2 | 2 | 2 | - |
| **CO5** | 2 | - | - | - | - | - | - | - | - | 2 | - | 2 | 3 | 3 | - |
| **Average** | **2** | - | - | - | - | - | - | - | - | **2** | - | **2** | **2.6** | **2.6** | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Computer Science and Engineering | Programme Code | 1031 |
|---|---|---|---|

**B.Tech – Artificial Intelligence & Data Science**

**II Semester**

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22CS13201 | DATA STRUCTURES | 3 | 1 | 0 | 4 | 100 |

| | |
|---|---|
| **Objectives** | **The student should be made to:**<br>● Know the concepts of abstract data types<br>● Learn the linear data structures – lists, stacks, and queues<br>● Familiar with non-linear data structures – Trees<br>● Gain the non-linear data structure – Graphs<br>● Learn the sorting, searching and hashing algorithms |
| **Outcomes** | **Upon completion of the course, the students should be able to:**<br>● Explain the concepts of abstract data types<br>● Classify the linear data structures to problem solutions<br>● Apply the different tree data structures to problem solutions<br>● Demonstrate the non-linear data structure – graph<br>● Interpret the various sorting, searching and hashing algorithms |

| | | |
|---|---|---|
| **UNIT-I** | **LINEAR DATA STRUCTURES – LIST** | **9** |
| Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal). | | |
| **UNIT-II** | **LINEAR DATA STRUCTURES – STACKS, QUEUES** | **9** |
| Stack ADT – Operations – Applications – Evaluating arithmetic expressions – Conversion of Infix to Postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – Applications of queues. | | |
| **UNIT-III** | **NON-LINEAR DATA STRUCTURES – TREES** | **9** |
| Tree ADT – Tree traversals – Binary Tree ADT – Expression trees – Applications of trees – Binary search tree ADT – AVL Trees – B-Tree – B+ Tree – Heap – Applications of heap – Tries. | | |
| **UNIT-IV** | **NON-LINEAR DATA STRUCTURES - GRAPHS** | **9** |
| Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs. | | |
| **UNIT-V** | **SEARCHING, SORTING AND HASHING TECHNIQUES** | **9** |
| Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Merge sort – Shell sort – Radix sort. Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing. | | |
| | **TOTAL HOURS** | **45 Hours** |

| | |
|---|---|
| **TEXT BOOK :** | |
| 1 | Mark Allen Weiss, "Data structures and Algorithm Analysis in C", Pearson Education, New Delhi, Second Edition, 2012. |
| 2 | Reema Thareja, —Data Structures Using C, Second Edition , Oxford University Press, 2011 |
| **REFERENCES:** | |
| 1 | Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest , Clifford Stein, "Introduction to Algorithms" ,3rd Edition, MIT Press, 2010 |
| 2 | Jean Paul Tremblay and Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill Publishing Company, New Delhi, Second Edition, 2007. |
| 3 | Yedidyah Langsam, Moshe J Augenstein and Aaron M Tanenbaum, "Data Structures using C and C++", Prentice Hall of India/ Pearson Education, New Delhi, 2006. |
| 4 | Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C,Second Edition, University Press, 2008 |
| 5 | NPTEL course, Data Structures and Algorithms, https://nptel.ac.in/courses/106102064/ |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 3 | - |
| **CO3** | 3 | 1 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO4** | 3 | 1 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 3 | - |
| **CO5** | 3 | 1 | 2 | - | - | - | - | - | - | - | 3 | 3 | 1 | 2 | - |
| **Average** | **3** | 2 | 2 | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **2.2** | **2.6** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE

(Autonomous)

Accredited by NAAC 'A' Grade & NBA Tier-I (WA) UG: CSE,ECE,EEE

Mahendhirapuri, Mallasamudram, Namakkal Dt. - 637 503.

**Regulations 2022**

**Batch 2022-2023 - III Semester**

**Batch 2023-2024 onwards - II Semester**

(Common to all B.E./B.Tech. Programmes)

| Course code | Course Name | Periods/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22HS11002 | Tamils and Technology | 1 | 0 | 0 | 1 | 100 |

| | | |
|---|---|---|
| **UNIT-I** | **WEAVING AND CERAMIC TECHNOLOGY** | 3 |

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

| | | |
|---|---|---|
| **UNIT-II** | **HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE** | 3 |

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

| | | |
|---|---|---|
| **UNIT-III** | **MANUFACTURING TECHNOLOGY** | 3 |

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

| | | |
|---|---|---|
| **UNIT-IV** | **AGRICULTURE AND IRRIGATION TECHNOLOGY** | 3 |

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

| | | |
|---|---|---|
| **UNIT-V** | **SCIENTIFIC TAMIL & TAMIL COMPUTING** | 3 |

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

| | |
|---|---|
| **TOTAL HOURS** | **15** |

| TEXT BOOK AND REFERENCE BOOKS | |
|---|---|
| 1. | தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை ( வெளியீடு தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்) |
| 2. | கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்) |
| 3. | கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் ( தொல்லியல் துறை வெளியீடு) |
| 4. | பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு) |
| 5. | Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print) |
| 6. | Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies. |
| 7. | Historical Heritage of the Tamils (Dr.S.V.Subaramanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies). |
| 8. | The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.) |
| 9. | Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) |
| 10 | Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author) |
| 11. | Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu) |
| 12. | Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book. |

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Computer Science and Engineering | Programme Code | 1031 |
|---|---|---|---|

**B.Tech – Artificial Intelligence And Data Science**

**II Semester**

| Course Code | Course Name | Hours/Week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22CS23201 | DATA STRUCTURES LAB | 0 | 0 | 3 | 1.5 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Learn to implement linear data structures and its applications<br>• Understand the applications of tree and implement its types<br>• Understand the basics of sorting and searching algorithms<br>• Learn basics of hashing and graph traversal techniques<br>• Be familiar with the recursive methods<br>• Learn the Techniques for Hashing Function |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Implement linear data structures and its applications<br>• Develop programs for applications of tree and its types<br>• Implement various sorting and searching algorithms<br>• Develop programs for hashing and graph traversal techniques<br>• Implement various recursive methods for problem solving |

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Array implementation of Stack and Queue ADTs |
| 2 | Array implementation of List ADT |
| 3 | Linked list implementation of List, Stack and Queue ADTs |
| 4 | Applications of List, Stack and Queue ADTs |
| 5 | Implementation of Binary Trees and operations of Binary Trees |
| 6 | Implementation of Binary Search Trees |
| 7 | Implementation of AVL Trees |
| 8 | Implementation of Heaps using Priority Queues. |
| 9 | Graph representation and Traversal algorithms |
| 10 | Applications of Graphs |
| 11 | Implementation of searching and sorting algorithms |
| 12 | Implementation of Hashing functions |
| | **TOTAL HOURS** **30** |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - |
| **CO2** | 3 | 2 | - | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 2 | - | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - |
| **Average** | **3** | **2** | **-** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **3** | **2.6** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**Syllabus - Regulation 2022**

| **Department** | **English** |
|---|---|

**I Semester – Non-Circuit Branches & ECE**
**II Semester – Circuit Branches (Except ECE)**
**(Common to all B.E./B.Tech. Programmes)**

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22EN21001** | **Personality Development Practice Laboratory** | 0 | 0 | 2 | 1 | **100** |

| | |
|---|---|
| **Objectives** | • To develop listening and speaking skills of students for a variety of purposes like making presentations, attending interviews and participating in discussions<br>• To enhance the non-verbal and social interaction skills of students for becoming effective communicators<br>• To enable learners to hone their linguistic (LSRW) skills with the help of Technology |
| **Outcomes** | **At the end of the course, the students will be able to**<br>• Understand the language proficiency and its techniques<br>• Prepare the resume with organized details<br>• Develop soft skills to excel in their career |

**LIST OF EXERCISES**

| | |
|---|---|
| 1. | Introduction to LSRW Skills |
| 2. | Listening Comprehension |
| 3. | Reading Comprehension |
| 4. | Common Errors in English |
| 5. | Interview Skills |
| 6. | Presentation skills |
| 7. | Body Language |
| 8. | Group Discussion |
| 9. | Soft Skills (Self-Confidence, Team Work, Time Management, Adaptability, Openness to Criticism) |
| 10. | Creative Writing |

**Total Hrs : 45**

**REFERENCE BOOKS:**

1. Joshi, Manmohan, ***Soft Skills***, 1st Edition. Bookboon, 2017
2. Raman, Meenakshi & Sangeeta Sharma. ***Technical Communication: Principles and Practice***, Ed.III, Oxford University Press, New Delhi. 2015

**Online Websites:**

https:// www.ted.com/talks
https://quizziz.com
www.pdfdrive.com

**Activity:**

Worksheets for relevant topics

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 3 | - |
| **CO2** | 2 | 2 | - | 3 | 3 | - | - | - | - | - | 3 | 3 | 2 | 3 | - |
| **CO3** | 2 | 2 | - | 3 | 3 | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **Average** | **2** | **2** | **-** | **3** | **3** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **2.6** | **2.6** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous)-Syllabus | | | | | | R 2019 |
|---|---|---|---|---|---|---|
| **DEPARTMENT:** | **SCIENCE &HUMANITIES** | **Programme Code & Name** | | | | **CY& CHEMISTRY** |
| **SEMESTER - I(For Non Circuit Branches) & SEMESTER – II( For Circuit Branches)** | | | | | | |
| **COURSE CODE** | **COURSE NAME** | **HOURS/WEEK** | | | **CREDIT** | **MAXIMUM MARKS** |
| **22CY22001** | **CHEMISTRY LABORATORY** | **L** | **T** | **P** | **C** | **100** |
| | | 0 | 0 | 3 | 1.5 | |
| **Objective(s)** | • Educate the theoretical concepts experimentally<br>• To impart skills in measurements.<br>• To design and plan the experimental procedure and to record and process the results.<br>• To reach non trivial conclusions of significant of the experiments. | | | | | |
| **Outcome(s)** | On completion of this course, students will have the knowledge in:<br>• Demonstrate laboratory practices, handling glassware, equipment, and chemical reagents.<br>• Experiment with different types of instruments for analysis of materials using small quantities involved for quick and accurate results<br>• Analyze different types of titrations for estimation of materials using more quantities involved for good results | | | | | |
| 1. | Determination of Total, Temporary & Permanent hardness of water by EDTA method | | | | | |
| 2. | Determination of alkalinity in water sample | | | | | |
| 3. | Determination of chloride content of water sample by argentometric method | | | | | |
| 4. | Determination of DO content of water sample by Winkler's method. | | | | | |
| 5. | Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer | | | | | |
| 6. | Estimation of iron content of the given solution using potentiometer | | | | | |
| 7. | Determination of strength of given hydrochloric acid using pH meter | | | | | |
| 8. | Conductometric titration of strong acid vs strong base | | | | | |
| 9. | Determination of strength of acids in a mixture using conductivity meter | | | | | |
| 10. | Conductometric precipitation titration using $BaCl_2$ and $Na_2SO_4$ | | | | | |
| 11. | Determination of CaO in Cement | | | | | |
| 12. | Estimation of iron content of the water sample using spectrophotometer (1,10- phenanthroline / thiocyanate method) – (**DEMO ONLY**) | | | | | |
| **REFERENCES** | | | | | | |
| 1. | Applied chemistry theory and practice by O. P. Vermani and A. K. Narula, second edition. | | | | | |
| 2. | Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore (1994). | | | | | |
| 3. | Kolthoff I.M. and Sandell E.B. et al. Quantitative chemical analysis, Mcmillan, Madras 1980 | | | | | |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | - | - | - | - | 1 | 2 | - | 2 | 3 | 3 | 2 | - |
| **CO2** | 3 | - | - | 2 | - | - | - | 1 | 2 | - | 3 | 2 | 2 | 3 | - |
| **CO3** | 2 | 3 | - | 2 | - | - | - | 1 | 2 | - | 3 | 3 | 3 | 3 | - |
| **Average** | **2.3** | **3** | **-** | **2** | **-** | **-** | **-** | **1** | **2** | **-** | **2.6** | **2.6** | **2.6** | **2.6** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

**Regulations 2022**

## III Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22MA12301 | Probability and Discrete Mathematics | 3 | 1 | 0 | 4 | BS |
| 2 | 22AI14301 | Application Based Programming In Python | 3 | 0 | 0 | 3 | PC |
| 3 | 22AI14302 | Computer Architecture and Organization | 3 | 0 | 0 | 3 | PC |
| 4 | 22AI14303 | Database Technology | 3 | 0 | 0 | 3 | PC |
| 5 | | Open Elective - 1 | 2 | 1 | 0 | 3 | OE |
| 6 | 22CY11001 | Environmental Science | 3 | 0 | 0 | - | MC |
| | **PRACTICAL** | | | | | | |
| 7 | 22AI24301 | Application Based Programming In Python Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 8 | 22AI24302 | Database Technology Laboratory | 0 | 0 | 3 | 1.5 | PC |
| | | **TOTAL** | **17** | **2** | **6** | **19** | |

# MAHENDRA ENGINEERING COLLEGE

**(Autonomous)**

| Syllabus | | | Regulations 2022 |
|---|---|---|---|
| **Department** | **MATHEMATICS** | **Programme Code** | |

**SEMESTER – III**

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| **22MA12301** | **Probability and Discrete Mathematics (CSE, CYBER , IT AI&DS)** | 3 | 1 | 0 | 4 | **100** |

**Objectives**

To enable the students to,

- Gain knowledge of random variables and various standard distributions and their properties.
- Familiarize the students with two dimensional discrete and continuous random variables, correlation and regression analysis.
- Study the types of large sample tests and small sample tests.
- Create simple mathematical proofs using positions and connectives and doing truth table analysis.
- Study various types of graphs including Euler graphs and Hamiltonian graphs.

**Outcomes**

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

- Apply the ideas of probability and random variables and various discrete and continuous probability distributions and their properties which can describe real life phenomena
- Solve the problems involving more than one random variables.
- Analyze testing of hypothesis of large samples and small samples.
- Create simple mathematical proofs using positions andconnectives and doing truth table analysis.
- Develop the given problem as graph terminology and solvewith techniques of graph theory.

| **UNIT-I** | **RANDOM VARIABLES** | **9+3** |
|---|---|---|

Probability Set Theory(Basics)Discrete and continuous random variables – Mathematical Expectation -Moments – Moment generating functions – Binomial, Poisson, Uniform, Exponential and Normal distributions-

| **UNIT-II** | **TWO - DIMENSIONAL RANDOM VARIABLES** | **9+3** |
|---|---|---|

| | | |
|---|---|---|
| Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Regression Analysis. | | |
| **UNIT-III** | **INFERENTIAL STATISTICS** | **9+3** |
| Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, Small samples test for single mean, difference of means -F-test - Chi-square test for goodness of fit and independence of attributes. | | |
| **UNIT-IV** | **PROPOSITIONAL CALCULUS** | **9+3** |
| Propositions – Logical connectives – Compound propositions – Conditional and biconditional propositions – Truth tables – Tautologies and contradictions – Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments - Validity of arguments. | | |
| **UNIT-V** | **GRAPHS AND GROUPS** | **9+3** |
| Graphs and graph models-Graph terminology and special types of graphs-Representing graphs and graph isomorphism -connectivity-Euler and Hamilton paths. Groups, Semi Groups, Sub Groups, Permutation Groups, Normal Subgroups and homomorphisms - Cosets and Lagrange's theorem | | |
| | Total | **(L:45+T:15): 60 Hrs** |

| | |
|---|---|
| TEXT BOOK : | |
| 1 | T.Veerarajan, "Discrete Mathematics, with Graph Theroy and Combinatorics", Tata McGraw Hill,4th Edition, 2017. |
| 2 | Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2014. |
| REFERENCES: | |
| 1 | Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, , 2016. |
| 2 | Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 2016. |
| 3 | Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, " Discrete Mathematical Structures", Fourth Indian reprint, Pearson Education Pvt Ltd., New Delhi, 2015. |
| 4 | Seymour Lipschutz and Mark Lipson, "Discrete Mathematics", Schaum's Outlines, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, Third edition, 2017. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | - | 2 | - | 2 | 3 | 3 | - |
| **CO2** | 3 | 3 | - | - | - | - | - | - | - | 2 | - | 2 | 3 | 3 | - |
| **CO3** | - | 3 | 2 | - | - | - | - | - | - | 3 | - | 2 | 2 | 2 | - |
| **CO4** | - | 2 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 3 | 3 | - |
| **CO5** | - | 2 | 2 | 2 | - | - | - | - | - | 2 | - | 2 | 3 | 3 | - |
| **Average** | **1** | 2 | **2** | **1** | **-** | **-** | **-** | **-** | **-** | **2** | **-** | **2** | **2.6** | **2.6** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE

**(Autonomous)**

## Syllabus

| **Department** | **Computer Science and Engineering** | **Programme Code** | **1161** |
|---|---|---|---|

**B.Tech – Artificial Intelligence & Data Science**

**III Semester**

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22AI14301** | **APPLICATION BASED PROGRAMMING IN PYTHON** | | | | | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Learn the basic principles of Python programming language.<br>• Be exposed with python data structures – list, tuples, and dictionaries.<br>• Learn the basics of python Modules, packages, files and standard library.<br>• Familiar with C++ classes using appropriate Inheritance and design principles.<br>• Demonstrate significant experience in data structures with the Python program. |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Apply basic constructs of Python Programming to solve simple problems<br>• Implement Python programs using control statement and functions<br>• Get familiar with implementation of object oriented concepts in python<br>• Perform string, file and Regular expression operations and process data<br>• Develop applications using GUI and web frameworks |

| **UNIT-I** | **INTRODUCTION** | 9 |
|---|---|---|

Basic Concepts: Keywords, identifiers and variables- Data types - type casting – user input – modules – operators – Flow control statements- Strings – Calendars and clocks

| **UNIT-II** | **FUNCTIONS AND DATA TYPES** | 9 |
|---|---|---|

Functions: Basics –function arguments – modules – Recursion – Special functions. Lists: Creating, traversing and slicing -functions – nested lists. Tuples: Creating, initializing and accessing – tuple functions – swapping tuples, unpacking tuples – Dictionaries: Basics of Creating, initializing and accessing – dictionary functions and methods-view objects.

| **UNIT-III** | **OBJECT ORIENTED PROGRAMMING** | 9 |
|---|---|---|

Concepts of OOP- OOP concepts for Python – Built in Attributes and methods –polymorphism- operator overloading - Inheritance and Namespace – Method types - Exceptions: Built-in and User

| | | |
|---|---|---|
| defined exceptions. | | |
| **UNIT-IV** | **STRINGS, FILES AND REGULAR EXPRESSIONS** | 9 |
| Strings: Built-in methods for string manipulation – Case studies. Modules and Packages : import statement – creating user defined modules and packages. Files: File operations –Reading and Writing a file. Regular Expressions: match, search, sub, find all and finite functions - Case studies. | | |
| **UNIT-V** | **USER INTERFACE AND GUI PROGRAMMING** | 9 |
| User Interface design: Tkinter - Events – Connecting with databases. Web Frameworks: - Web servers - Introduction to web server frameworks (Bottle, Django and Flask) | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Anurag Gupta, G P Biswas. Python Programming, McGraw Hill Education, 1st Edition, 2020. |
| 2 | Ashok Namdev Kamthane,Amit Ashok Kamthane, Programming and Problem Solving with Python , Mc-Graw Hill Education,2018. |
| **REFERENCES:** | |
| 1 | Bill Lubanovic, ―Introducing Python Modern Computing in Simple Packages, 2nd Edition, O'Reilly Media, 2019. |
| 2 | Samuel Dauzon, Aidas Bendoraitis and Arun Ravindran. Django: Web Development with Python: Web Development with Python. Packt Publisher, 1st Edition, 2017 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | 2 | 2 | 3 | 3 | 3 | - |
| **CO2** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | 2 | 2 | 3 | 3 | - | - |
| **CO3** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | 3 | 2 | 3 | 3 | - | - |
| **CO4** | 2 | 2 | - | 2 | 2 | - | - | - | - | 2 | 1 | 2 | 3 | - | - |
| **CO5** | 1 | 2 | - | 1 | 1 | - | - | - | - | 2 | 1 | 2 | 2 | - | - |
| **Average** | **2** | 3 | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **2** | **1** | **3** | **2** | **3** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE

**(Autonomous)**

## Syllabus

| **Department** | **Artificial Intelligence And Data Science** | **Programme Code** | **1161** |
|---|---|---|---|

## III Semester

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22AI14302** | **COMPUTER ARCHITECTURE AND ORGANIZATION** | 3 | 0 | 0 | 3 | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Learn the basic structure and operations of a computer.<br>• Learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit.<br>• Gain the basics of pipelined execution, understand parallelism and multi-core processors.<br>• Know the memory hierarchies, cache memories and virtual memories.<br>• Learn the different ways of communication with I/O devices. |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Identify the basics structure of computers, operations and instructions.<br>• Design arithmetic and logic unit.<br>• Explain pipelined execution and design control unit.<br>• Discuss the various memory systems and I/O communication.<br>• Explain the different way of communication with I/O devices. |

| **UNIT-I** | **BASIC STRUCTURE OF A COMPUTER SYSTEM** | 9 |
|---|---|---|
| Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Representing Instructions in the computer - Instruction Set Architecture – Instruction And Instruction Sequencing – Addressing Mode – Assembly Language | | |
| **UNIT-II** | **ARITHMETIC FOR COMPUTERS** | 9 |
| Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations –Parallelism and Computer Associativity | | |
| **UNIT-III** | **PROCESSOR AND CONTROL UNIT** | 9 |
| A Basic MIPS implementation – Building a Data path – Control Implementation Scheme – Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards – Exceptions. | | |
| **UNIT-IV** | **PARALLELISIM** | 9 |
| Parallel processing challenges – Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors. | | |
| **UNIT-V** | **MEMORY & I/O SYSTEMS** | 9 |

| | |
|---|---|
| Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB‘s – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits - USB. | |
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Sixth Edition, Morgan Kaufmann / Elsevier, 2020. |
| 2 | Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012. |
| **REFERENCES:** | |
| 1 | William Stallings, Computer Organization and Architecture – Designing for Performance, Eleventh Edition, Pearson Education, 2020 |
| 2 | John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012. |
| 3 | John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **CO3** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO4** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **Average** | **3** | 2 | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **1** | **1** | **-** |

**1 - Low, 2 - Medium, 3 - High, ‘-“- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

## III Semester

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI14303 | DATABASE TECHNOLOGY | 3 | 0 | 0 | 3 | 100 |

**Objective(s)**

**The student should be made :**

- To learn the fundamentals of data models, conceptualize and depict a database system using ER diagram.
- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To learn about the internal storage structures using different file and indexing techniques and the basics of query processing and optimization.
- To study the basics of distributed databases, semi-structured and un-structured data models.

**Outcome(s)**

**Upon completion of the course, the students should be able to:**

- Model an application's data requirements using conceptual modeling and design
  Database schemas based on the conceptual model.
- Formulate solutions to a broad range of query problems using relational algebra/SQL.
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
- Run transactions and estimate the procedures for controlling the consequences of
  Concurrent data access.
- Explain basic database storage structures, access techniques and query processing.

| UNIT-I | RELATIONAL DATABASES | 9 |
|---|---|---|

Purpose of Database System – Views of Data – Data Models – Database System Architecture – Introduction to Relational Databases – Relational Model – Keys – Relational Algebra – Relational Calculus – SQL Fundamentals – Advanced SQL features – Triggers – Embedded SQL.

| UNIT-II | DATABASE DESIGN | 9 |
|---|---|---|

Entity-Relationship Model – ER Diagrams – Functional Dependencies – Non-Loss Decomposition Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form – Dependency Preservation – Boyce/Codd Normal Form – Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

| | | |
|---|---|---|
| **UNIT-III** | **TRANSACTION MANAGEMENT** | **9** |
| Transaction Concepts – ACID Properties – Serializability – Transaction Isolation Levels – Concurrency Control – Need for Concurrency – Lock-Based Protocols – Deadlock Handling – Recovery System – Failure Classification – Recovery Algorithm. | | |
| **UNIT-IV** | **IMPLEMENTATION TECHNIQUES** | **9** |
| Overview of Physical Storage Media – RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Catalog Information for Cost Estimation – Query Optimization. | | |
| **UNIT-V** | **ADVANCED TOPICS** | **9** |
| Overview of Distributed Databases – Data Fragmentation – Replication – XML Databases – XML Schema – NOSQL Database: Characteristics – CAP theorem – Types of No SQL Data stores: Column Oriented, Document, Key-Value and Graph Types – Applications – Current Trends. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS :** | |
|---|---|
| 1 | Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2014. |
| 2 | Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017. |
| **REFERENCES:** | |
| 1 | C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006. |
| 2 | Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Fourth Edition, Tata McGraw Hill, 2010. |
| 3 | G. K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011. |
| 4 | Carlos Coronel, Steven Morris, Peter Rob, "Database Systems: Design, Implementation and Management", Ninth Edition, Cengage Learning, 2011. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO2** | 2 | 3 | 1 | 3 | 1 | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **CO3** | 2 | 2 | 2 | 1 | 1 | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO4** | 2 | 2 | 3 | 1 | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **CO5** | 3 | 1 | 3 | 2 | 1 | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **Average** | **2** | **2** | **2** | **2** | **1** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **1** | **1** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

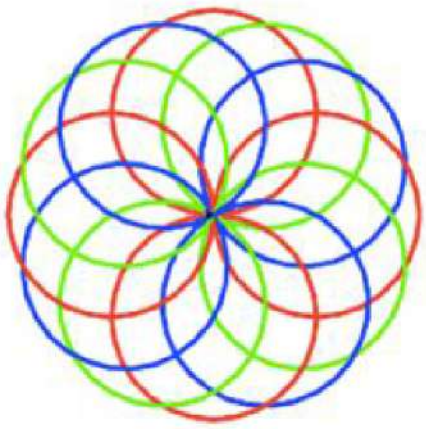
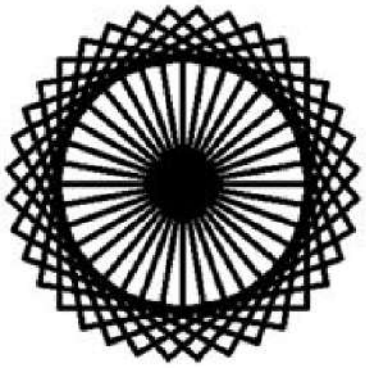
**III Semester**

| Course Code | Course Name | Hours/Week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI24301 | Application Based Programming In Python Lab | 0 | 0 | 3 | 1.5 | 100 |

| | |
|---|---|
| **Objective(s):** | **The student should be made to:**<br>● Write, test, and debug simple Python programs.<br>● Implement Python programs with conditionals and loops.<br>● Use functions for structuring Python programs.<br>● Represent compound data using Python lists, tuples, dictionaries.<br>● Read and write data from/to files in Python. |
| **Outcome(s):** | **Upon completion of the course, the students should be able to:**<br>● Write, test, and debug simple Python programs.<br>● Implement Python programs with conditionals and loops.<br>● Develop Python programs step-wise by defining functions and calling them.<br>● Use Python lists, tuples, dictionaries for representing compound data.<br>● Implement programs to read and write data from/to files in Python. |

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1 | Write a python program to find largest of three numbers |
| 2 | Write a python program to construct the following pattern using nested for loop: |
| 3 | Write a program to demonstrate working with tuples in python |
| 4 | Write a program to demonstrate working with dictionaries in python |
| 5 | Write a python program to construct the following pattern using nested for loop:<br>*<br>**<br>***<br>****<br>*****<br>*****<br>****<br>***<br>**<br>* |
| 6 | Write a python program to find factorial of a number using recursion |
| 7 | Install packages requests, flask and explore using (pip) |
| 8 | Elliptical orbits in Pygame |
| 9 | Simulate bouncing ball using Pygame |

| | |
|---|---|
| 10 | Write a Python program to find the substrings within a string using re module |
| 11 | Create a class ATM and define ATM operations to create account, deposit, check_balance, withdraw and delete account. Use constructor to initialize members |
| 12 | Design a GUI based calculator to perform arithmetic operations like addition, subtraction, multiplication and division. ( Hint: Expression Calculator using tk) |
| 13 | Write a python program to read the file contents and do the following operations:<br>i) Print each word of a file in reverse order.<br>ii) Print each line of a file in reverse order.<br>Sample Input: Python Programming<br>Sample Output: Programming Python<br>iii) Display the content without whitespaces<br>Sample Output: Python Programming |
| 14 | Write a python program to perform various database operations (create, insert, delete, update). |
| 15 | Write a python program to implement the following figures using turtle<br>   |
| | **TOTAL HOURS** \| **30 HOURS** |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 3 | 3 | - |
| **CO2** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 3 | 3 | - |
| **CO3** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 3 | 3 | - |
| **CO4** | 2 | 2 | | 2 | 2 | - | - | - | - | - | 1 | - | 3 | 2 | - |
| **CO5** | 1 | 2 | - | - | 1 | - | - | - | - | - | 1 | - | 2 | 3 | - |
| **Average** | **3** | **3** | **3** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **2** | **2** | **3** | **2.8** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**MAHENDRA ENGINEERING COLLEGE**

| (Autonomous) | | | |
|---|---|---|---|
| **Syllabus** | | | |
| **Department** | **Artificial Intelligence And Data Science** | **Programme Code** | **1161** |

**III Semester**

| Course Code | Course Name | Hours/Week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| **22AI24302** | **DATABASE TECHNOLOGY LABORATORY** | **0** | **0** | **3** | **1.5** | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Learn and implement important commands in SQL.<br>• Learn the usage of nested and joint queries.<br>• Familarize the functions, procedures and procedural extensions of databases.<br>• Design and implementation of typical database applications.<br>• Be familiar with the use of a front end tool for GUI based application development. |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Create databases with different types of key constraints.<br>• Write simple and complex SQL queries using DML and DCL commands.<br>• Realize database design using 3NF and BCNF.<br>• Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.<br>• Create XML database and validate with meta-data (XML schema). |

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands. |
| 2. | Create set of tables, add foreign key constraints and incorporate referential integrity. |
| 3. | Query the database tables using different 'where' clause conditions and also Implement aggregate functions. |
| 4. | Query the database tables and explore sub queries and simple join operations. |
| 5. | Query the database tables and explore natural, equi and outer joins. |
| 6. | Write user defined functions and stored procedures in SQL. |
| 7. | Execute complex transactions and realize DCL and TCL commands. |
| 8. | Write SQL Triggers for insert, delete, and update operations in database table. |
| 9. | Create View and index for database tables with large number of records. |
| 10. | Create a XML database and validate it using XML schema. |

| | | |
|---|---|---|
| 11. | Create Document, column and graph based data using NOSQL database tools. | |
| 12. | Develop a simple GUI based database application and incorporate all the above-Mentioned features. | |
| | **TOTAL HOURS** | **45** |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | 3 | - | - | - | - | 3 | 1 | 3 | 2 | 3 | 3 | - |
| CO2 | 2 | 2 | 3 | 2 | 2 | - | - | - | 1 | 2 | 3 | 2 | 3 | 2 | - |
| CO3 | 3 | 3 | 2 | 1 | 1 | - | - | - | 1 | 1 | 1 | - | 3 | 3 | - |
| CO4 | 1 | 3 | 3 | 3 | 1 | - | - | - | 1 | 1 | 3 | - | 3 | 3 | - |
| CO5 | 3 | 2 | 1 | 1 | 1 | - | - | - | 2 | 2 | 3 | - | 2 | 2 | - |
| **Average** | **2** | **3** | **2** | **2** | **1** | **-** | **-** | **-** | **2** | **1** | **3** | **2** | **3** | **3** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulations 2022**

## IV Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22SH11401 | Universal Human Values | 3 | 0 | 0 | 3 | MC |
| 2 | 22AI14401 | Foundations of Data Science | 3 | 0 | 0 | 3 | PC |
| 3 | 22AI14402 | Introduction To Artificial Intelligence | 3 | 0 | 0 | 3 | PC |
| 4 | 22CS14403 | Java Programming | 3 | 0 | 0 | 3 | PC |
| 5 | | Program Elective – I | 3 | 0 | 0 | 3 | PE |
| 6 | | Open Elective - 2 | 3 | 0 | 0 | 3 | OE |
| | **PRACTICAL** | | | | | | |
| 7 | 22AI24401 | Artificial Intelligence and Java Programming Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 8 | 22AI34402 | Operating Systems (Integrated) | 2 | 0 | 2 | 3 | PC |
| 8 | 22EN60001 | Professional Communicative Skills | 0 | 1 | 2 | 2 | HS |
| | | **TOTAL** | **20** | **1** | **7** | **24.5** | |

**MAHENDRA ENGINEERING COLLEGE**
**(Autonomous)**

**Syllabus**

| **Department** | **Artificial Intelligence And Data Science** | **Programme Code** | **1161** |
|---|---|---|---|

**IV Semester**

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22AI14401** | **Foundations of Data Science** | 3 | 0 | 0 | 3 | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Gain knowledge in the basic concepts of Data Analysis<br>• Acquire skills in data preparatory and preprocessing steps<br>• Learn the tools and packages in Python for data science<br>• Gain understanding in classification and Regression Model<br>• Acquire knowledge in data interpretation and visualization techniques. |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Apply the skills of data inspecting and cleansing.<br>• Determine the relationship between data dependencies using statistics<br>• Can handle data using primary tools used for data science in Python<br>• Represent the useful information using mathematical skills<br>• Can apply the knowledge for data describing and visualization using tools. |

| **UNIT-I** | **INTRODUCTION** | 9 |
|---|---|---|

Introduction to data science – benefits and uses – facts of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – Machine learning and data science – Types of machine learning

| **UNIT-II** | **DESCRIBING DATA I** | 9 |
|---|---|---|

Statistics – Three types of data - Frequency distributions – Outliers – relative frequency distributions – cumulative frequency distributions – graphs – Quantitative data – Typical types - averages – mode – median – mean – averages for qualitative and ranked data – describing variability – range – variance – standard deviation – degrees of freedom – interquartile range – variability for qualitative and ranked data

| **UNIT-III** | **PYTHON FOR DATA HANDLING** | 9 |
|---|---|---|

Understanding data types in python - Basics of Numpy arrays – aggregations – computations on arrays – comparisons, masks, Boolean logic – fancy indexing – sorting array - structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

| **UNIT-IV** | **DESCRIBING DATA II** | 9 |
|---|---|---|

Normal distributions – z scores – Standard normal curve – finding proportions – finding scores –correlation – scatter plots – correla coefficient for quantitative data –other types of correlation coefficients – regression – two rough predictions - regression line – least squ regression line – standard error of estimate – interpretation of r2 – multiple regression equations – regression toward the mean

| **UNIT-V** | **PYTHON FOR DATA VISUALIZATION** | 9 |
|---|---|---|

Visualization with matplotlib – line plots – scatter plots – visualizing errors – density and contour plots – histograms, binnings, and density – customizing plot legends and colorbars – multiple subplots – geographic data with base map – data analysis using statmodels and seaborn

**TEXT BOOKS :**


| | | |
|---|---|---|
| 1 | David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016 | |
| 2 | Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. | |


**REFERENCES:**


| | | |
|---|---|---|
| 1 | Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014 | |
| 2 | Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016 | |
| 3 | Rupam Kumar Sharma Gypsy Nandi,” Data Science Fundamentals And Practical Approaches”, BPB Publications | 2020 |

| | |
|---|---|
| **TOTAL HOURS** | |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 1 | 2 | 2 | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 | - |
| CO2 | 2 | 1 | - | 1 | 1 | - | - | - | 2 | 1 | 1 | 2 | 2 | 3 | - |
| CO3 | 2 | 2 | 1 | 2 | 2 | - | - | - | 1 | 2 | 1 | 3 | 2 | 2 | - |
| CO4 | 3 | 2 | 2 | 2 | 1 | - | - | - | 1 | 1 | 2 | 2 | 3 | 2 | - |
| CO5 | 2 | 2 | 1 | 2 | 2 | - | - | - | 1 | 1 | 1 | 2 | 2 | 2 | - |
| **Average** | **2** | **2** | **1** | **2** | **2** | **-** | **-** | **-** | **1** | **1** | **1** | **2** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

## IV Semester

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI14402 | INTRODUCTION TO ARTIFICIAL INTELLIGENCE | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Study the concepts of Artificial Intelligence<br>• Learn the methods of solving problems using Artificial Intelligence<br>• Introduce the concepts of Expert Systems and machine learning<br>• To apply Artificial Intelligence techniques for K-strips<br>• To apply Artificial Intelligence techniques of empirical evaluation of different algorithms on a problem formalisation, |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Identify problems that are amenable to solution by AI methods.<br>• Identify appropriate AI methods to solve a given problem.<br>• Formalise a given problem in the language/framework of different AI methods.<br>• Implement basic AI algorithms.<br>• Design and carry out an empirical evaluation of different algorithms on a problem formalisation, and state the conclusions that the evaluation supports. |

| **UNIT-I** | **INTELLIGENT AGENTS** | **9** |
|---|---|---|
| Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies. | | |
| **UNIT-II** | **REPRESENTATION OF KNOWLEDGE** | **9** |
| Game playing - Knowledge representation- Knowledge representation uses Predicate logic- Introduction to predicate calculus- Resolution- Use of predicate calculus- Knowledge representation using other logic-Structured representation of knowledge. | | |
| **UNIT-III** | **KNOWLEDGE INFERENCE** | **9** |
| Knowledge representation -Production based system- Frame based system. Inference - Backward chaining- Forward chaining- Rule value approach- Fuzzy reasoning - Certainty factors- Bayesian Theory-Bayesian Network-Dempster - Shafer theory. | | |
| **UNIT-IV** | **PLANNING** | **9** |
| Basic plan generation systems - Strips -Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. | | |

| | | |
|---|---|---|
| **UNIT-V** | **EXPERT SYSTEMS** | **9** |
| Expert systems - Architecture of expert systems- Roles of expert systems - Knowledge Acquisition – Meta knowledge- Heuristics. Typical expert systems - MYCIN, DART, Expert systems shells. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS :** | |
| 1 | Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill- 2008. . |
| 2 | Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007. |
| **REFERENCES:** | |
| 1 | Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007. |
| 2 | Stuart Russel and Peter Norvig "AI – A Modern Approach", 3rd Edition, Pearson Education 2016. |
| 3 | Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013. |
| **E REFERENCES:** | |
| 4 | http://nptel.ac.in/ |
| 5 | https://www.csail.mit.edu |
| 6 | https://ai.stanford.edu |
| 7 | www.andrewng.org |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | - | 3 | 3 | - | 3 | 3 | - |
| **CO2** | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | - | 3 | 3 | - |
| **CO3** | - | 3 | 2 | - | - | 2 | - | - | - | 3 | 3 | - | 3 | 3 | - |
| **CO4** | - | 2 | 2 | 2 | - | - | - | - | - | 3 | 3 | - | 3 | 2 | - |
| **CO5** | - | 2 | 2 | 2 | - | - | - | - | - | 3 | 3 | - | 2 | 3 | - |
| **Average** | **3** | 3 | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **-** | **3** | **2.8** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| **Department** | **Computer Science and Engineering** | **Programme Code** | **1031** |
|---|---|---|---|

**B.Tech – Artificial Intelligence & Data Science**

**IV Semester**

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22CS14403** | **JAVA PROGRAMMING** | 3 | 0 | 2 | 4 | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>● To Implement program for user interface and application development using core java principles<br>● To Learn java programming constructs, control structures in java<br>● To Know object oriented constructs such as various class hierarchies, interfaces and exception handling<br>● To Understand the thread concepts and I/O in java<br>● To Familiarize in basic network programs in java |
| **Outcome(s)** | **Upon completion of this course, student will be able to:**<br>● Describe the basics of OOP concepts using Java<br>● Outline the syntax of programming constructs using Java<br>● Explain the role of interface and exceptions in Java<br>● Apply the concepts of multithreading using Java<br>● Develop the basics of concurrent and network programming concepts |

| **UNIT-I** | **INTRODUCTION TO OOPS** | **9** |
|---|---|---|

Introduction - need of object oriented programming - principles of object oriented languages - procedural languages Vs. OOPs - applications of OOPs - history of JAVA - java virtual machine java features - program structures - installation of JDK1.6

| **UNIT-II** | **PROGRAMMING CONSTRUCTS** | **9** |
|---|---|---|

Variables - primitive data types – identifiers - naming conventions – keywords – literals – operators – binary - unary and ternary – expression - precedence rules and associativity - primitive type conversion and casting - flow of control – arrays- command line arguments.

| **UNIT-III** | **INTERFACE AND EXCEPTIONS** | **9** |
|---|---|---|

Types of inheritance – interface - interface vs abstract classes - packages-creating packages - access protection -java.lang package - exception handling techniques - user defined exception - exception encapsulation – enrichment – assertions

| **UNIT-IV** | **MULTITHREADING** | **9** |
|---|---|---|

| | | |
|---|---|---|
| The main thread - creation of new threads - thread priority – multithreading - using is Alive () and join () – Synchronization - suspending and resuming threads - communication between threads - reading and writing data. | | |
| **UNIT-V** | **CONCURRENT AND NETWORK PROGRAMMING** | **9** |
| Threads – Thread states – Interrupting threads – Thread communication - Networking basics – Java and the Net - InetAddress – TCP/IP Server Sockets – Remote Method Invocation – A simple client/server application using RMI. | | |
| | Total hours to be taught | **L:45 PERIODS** |

| | |
|---|---|
| **TEXT BOOK :** | |
| 1 | Herbert Schildt, "Java The Complete Reference", TMH, 2014. |
| **REFERENCES:** | |
| 1 | Elliotte Rustry Harold, "Java Network Programming", O'Reilly, 2014. |
| 2 | Peter Haggar, "Practical Java Programming Language Guide", Addison Wesley, 2000. |
| 3 | Daniel Liang Y, "An Introduction to Java Programming", PHI pvt ltd, 2003. |
| 4 | Coursera, Java Programming: Solving Problems with Software, https://www.coursera.org/learn/java-programming |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | 3 | 1 | 3 | - | - | - | 3 | 2 | 3 | 3 | 3 | 2 | - |
| **CO2** | 2 | 1 | 3 | 2 | 1 | - | - | - | 2 | 1 | 3 | 3 | 3 | 1 | - |
| **CO3** | 3 | 3 | 1 | 2 | 2 | - | - | - | 3 | 2 | 2 | 3 | 3 | 2 | - |
| **CO4** | 3 | 1 | 2 | 2 | 2 | - | - | - | 1 | 2 | 3 | 3 | 3 | 2 | - |
| **CO5** | 1 | 1 | 2 | 3 | 2 | - | - | - | 3 | 2 | 3 | 3 | 3 | 2 | - |
| **Average** | **2** | 1 | **2** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **3** | **3** | **3** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY**

**Course Code: H-102; Credits: 3**

L-T-P-C: 2-1-0-3 or 2L: 1T:0P 3 Credits

Pre-requisites: None. Universal Human Values 1 (Induction Programme) (desirable)

The foundation course "H-102 Universal Human Values 2: "Understanding Harmony" may be covered in III or IV semester. This course discusses the role of human beings in their family. It also touches issues related to their role in the society and the nature. During the Induction Program, students would get an initial exposure to human values through Universal Human Values 1. This exposure is to be augmented by this compulsory full semester foundation course.

## 1. OBJECTIVE:

The objective of the course is four-fold:

(i). Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

(ii). Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence

(iii). Strengthening of self-reflection.

(iv). Development of commitment and courage to act.

## 2. COURSE TOPICS:

The course has 5 Modules (5 Units) : 30 Lectures and 15 Practice sessions (Tutorials).

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**

L 1. Purpose and motivation for the course, recapitulation from Universal Human Values-I (Induction Programme).

L 2. Self-Exploration–what is it? Its content and process; 'Natural Acceptance' and Experiential Validation-as the process for self-exploration.

L 3. Continuous Happiness and Prosperity - A look at basic Human Aspirations.

L 4. Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority.

L 5. Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario.

L 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

3 Practice sessions *(T1 to T3) - To discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.*

**Module 2: Understanding Harmony in the Human Being - Harmony in Myself!**

L 7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
L 8. Understanding the needs of Self ('I') and 'Body'- happiness and physical facility
L 9. Understanding the Body as an instrument of 'I'(I being the doer, seer and enjoyer)
L 10.Understanding the characteristics and activities of 'I' and harmony in 'I'
L 11.Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
L 12.Programs to ensure Sanyam and Health.

3 Practice sessions *(T4 to T6) - To discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease*.

**Module 3: Understanding Harmony in the Family and Society - Harmony in Human-Human Relationship**

L 13. Understanding values in human-human relationship; meaning of Justice (Nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
L 14. Understanding the meaning of Trust; Difference between intention and competence.
L 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
L 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.
L 17. Visualizing a universal harmonious order in Society-Undivided Society, Universal Order-from family to world family.

3 Practice sessions *(T7 to T9) Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.*

**Module4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

L 18. Understanding the harmony in the Nature.
L 19. Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature.
L 20. Understanding Existence as Co-existence of mutually interacting units in all - pervasive space.
L 21. Holistic perception of harmony at all levels of existence.

2 Practice sessions *(T10 to T11) Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc.*

**Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics**

L 22. Natural acceptance of human values.
L 23. Definitiveness of Ethical Human Conduct.
L 24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
L 25. Competence in professional ethics: (a). Ability to utilize the professional competence for augmenting universal human order (b). Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, (c). Ability to identify and develop appropriate technologies and management patterns for above production systems.

L 26. Case studies of typical holistic technologies, management models and production systems.
L 27. Strategy for transition from the present state to Universal Human Order: (a). At the level of individual: as socially and ecologically responsible engineers, technologists and managers (b). At the level of society: as mutually enriching institutions and organizations.
L 28. Definition of Morals, Values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully.
L 29. Importance of Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality.
L 30. Introduction to Yoga and meditation for professional excellence and stress management. *Sum up.*

4 Practice sessions *(T12 to T15) - Include Practice Exercises and Case Studies which will be taken up in Practice (Tutorial) Sessions.*
*eg. To discuss the conduct as an Engineer or Scientist, etc.*

**TOTAL = 45 Periods**

**3. READINGS**:

**3.1 Textbook**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

**3.2 Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth -by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews.
7. Economy of Permanence - J C Kumarappa.
8. Bharat Mein Angreji Raj - Pandit Sunderlal.
9. Rediscovering India by Dharampal.
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
11. India Wins Freedom - Maulana Abdul Kalam Azad.
12. Vivekananda - Romain Rolland (English).
13. Mika Martin and Roland Scinger, 'Ethics in Engineering', Pearson Education/Prentice Hall, New York 1996.

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence And Data Science** | **Programme Code** | | | | **1161** |
| **IV Semester** | | | | | | |
| **Course Code** | **Course Name** | **Hours /Week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI24401** | **ARTIFICIAL INTELLIGENCE AND JAVA PROGRAMMING LABORATORY** | **0** | **0** | **3** | **1.5** | **100** |
| **Objective(s)** | • To write simple programs of Python programming language<br>• To understand the set operations, Matrices<br>• Understand how to implement a specified data structure using OOP concepts<br>• To develop simple java programs with object oriented programming concepts<br>• Learn to implement applications using Applets and event driven programming | | | | | |
| **Outcome(s)** | **Upon completion of this course, student will be able to**<br>• Run their application on the instantiated Python language<br>• Simulate their sample proposed systems for AI<br>• Develop simple java programs using object oriented concepts<br>• Develop programs to implement different data structures<br>• Develop applications using Applets and event driven programming concepts | | | | | |

## LIST OF EXPERIMENTS

**Artificial Intelligence Programming**

| | |
|---|---|
| 1. | Write a python program to print the multiplication table for the given number. |
| 2. | Write a python program to generate Calendar for the given month and year. |
| 3. | Write a python program to implement Water Jug Problem. |
| 4. | Give a program to implement Hangman game using python. |
| 5. | Write a program to implement Tic-Tac-Toe game using python. |

**Java Programming**

| | |
|---|---|
| 1. | a.Write a java program to find the Fibonacci series using recursive and non-recursive functions<br>b. Write a program to multiply two given matrices.<br>c. Write a program for Method overloading and Constructor overloading |
| 2. | a.Write a program to demonstrate execution of static blocks ,static variables & static methods.<br>b.Write a program for sorting a given list of names in ascending order |
| 3. | a.Write a program to implement single and Multi level inheritance<br>b.Write a program to implement Hierarchical Inheritance<br>c.Write a program to implement method overriding. |
| 4. | a. Write a program to implement Interface.<br>b. Write a program to implement multiple and Hybrid Inheritance |
| 5. | a.Write a program to create user defined package and demonstrate various access modifiers<br>b.Write a program to demonstrate the use of super and final keywords |
| 6. | Write a Program to implement simple Thread by extending Thread class and implementing runnable interface. |
| 7. | Write a program for producer and consumer problem using Threads |
| 8. | Write an applet program that displays a simple message |
| | **TOTAL HOURS** **30** |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 3 | 3 | - | - | - | - | 1 | 1 | 2 | 1 | 3 | 3 | - |
| **CO2** | 1 | 2 | 3 | 3 | - | - | - | - | 3 | 2 | 3 | 3 | 3 | 3 | - |
| **CO3** | 3 | 1 | 3 | 3 | - | 2 | - | - | 1 | 3 | 1 | 2 | 3 | 3 | - |
| **CO4** | 2 | 1 | 1 | 1 | - | - | - | - | 2 | 3 | 1 | 2 | 3 | 2 | - |
| **CO5** | 3 | 1 | 1 | 1 | - | - | - | - | 1 | 3 | 3 | 3 | 2 | 3 | - |
| **Average** | **3** | 1 | **2** | **2** | **-** | **-** | **-** | **-** | **2** | **2** | **2** | **2** | **3** | **2.8** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

**IV Semester**

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI34402 | OPERATING SYSTEMS | 2 | 0 | 2 | 3 | 100 |

**Objective(s)**

**Theory:**
- Learn the fundamentals of Processes and Threads
- Analyze various scheduling and memory managementschemes.

**Laboratory:**
- Learn Unix commands and shellprogramming
- Implement various CPU SchedulingAlgorithms
- Knowledge about advanced concepts in OS
- Ability to develop OS for distributed systems

**Outcome(s)**

**At the end of the course, the students should be able to:**

**Theory:**
- Analyze various Processes and Threads ,schedulingalgorithms.
- Compare and contrast memory and storage managementschemes.

**Laboratory**:
- Compare the performance of various CPU SchedulingAlgorithms
- Implement Deadlock avoidance and DetectionAlgorithms
- ImplementSemaphores
- Analyze the performance of the various Page ReplacementAlgorithms

| UNIT-I | FUNDAMENTALS OF OPERATING SYSTEMS & Scheduling | 7 |
|---|---|---|

Overview –System calls- Processes and Threads –Process scheduling -CPU Scheduling. Interprocess Communication. Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.Message Passing.

| UNIT-II | SYNCHRONIZATION AND MEMORY MANAGEMENT | 8 |
|---|---|---|

The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions; Main Memory- Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging,Virtual Memory- Page Replacement, -Allocating Kernel Memory.Disk Scheduling.

**LISTOF EXPERIMENTS**

1. Study of hardware and software requirements of different Operating Systems.(UNIX,LINUX,WINDOWS)
2. Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc.
3. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
4. Implement the various CPU Scheduling Algorithms

a)FCFS b)SJS

5. Implement the various CPU Scheduling Algorithms
   a) Priority Scheduling b)Round Robin Scheduling
6. Bankers Algorithm for Deadlock Avoidance
7. Implementation of Deadlock Detection Algorithm
8. Implement the Producer-Consumer Problem in Semaphore.
9. Write C program to implement Threading Applications.
10. Implementation of the following Memory Allocation Methods for fixed partition

a)First Fit b) Worst Fit c) Best Fit

11. Implementation of the following Page Replacement Algorithms

a)FIFO b) LRU c) LFU

| | |
|---|---|
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, -Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012. |
| **REFERENCES:** | |
| 1 | RamazElmasri, A. Gil Carrick, David Levine, ―Operating Systems – A Spiral Approach, Tata McGraw Hill Edition, 2010. |
| 2 | AchyutS.Godbole, AtulKahate, ―Operating Systems, Mc Graw Hill Education, 2016. |
| 3 | Andrew S. Tanenbaum, ―Modern Operating Systems, Second Edition, Pearson Education, 2004. |
| 4 | Gary Nutt, ―Operating Systems, Third Edition, Pearson Education, 2004. |
| 5 | Harvey M. Deitel, ―Operating Systems, Third Edition, Pearson Education, 2004. |
| 6 | Daniel P Bovet and Marco Cesati, ―Understanding the Linux kernel, 3rd edition, O'Reilly, 2005. |
| 7 | Neil Smyth, ―iPhone iOS 4 Development Essentials – Xcode, Fourth Edition, Payload media, 2011. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | 2 | 1 | - | - | - | 2 | 2 | 3 | 3 | 2 | 2 | - |
| **CO2** | 2 | 1 | - | 2 | 2 | - | - | - | 2 | 1 | 3 | 3 | 1 | 1 | - |
| **CO3** | 3 | 2 | - | 2 | 2 | - | - | - | 3 | 2 | 3 | 3 | 1 | 1 | - |
| **Average** | **3** | 2 | **-** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **3** | **3** | **1** | **1** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulations 2022**

## V Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22AI14501 | Big Data Analytics | 3 | 0 | 0 | 3 | PC |
| 2 | 22AI14502 | Machine Learning Techniques | 3 | 0 | 0 | 3 | PC |
| 3 | | Program Elective – 2 | 3 | 0 | 0 | 3 | PE |
| 4 | | Open Elective - 4 | 3 | 0 | 0 | 3 | PC |
| 5 | | Open Elective - 5 | 2 | 1 | 0 | 3 | OE |
| 6 | | Constitution of India | 3 | 0 | 0 | - | MC |
| | **PRACTICAL** | | | | | | |
| 7 | 22AI24501 | Big Data Analytics Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 8 | 22AI24502 | Machine Learning Techniques Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 9 | | Interview Skills and Soft Skills | 0 | 1 | 3 | 2 | HS |
| | | **TOTAL** | **17** | **2** | **9** | **20** | |

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

## V Semester

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI14501 | BIG DATA ANALYTICS | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Familiarize the concepts of big data<br>• Explore the fundamental concepts of big data and analytics<br>• Learn the basics of big data technologies.<br>• Design applications using Map Reduce Concepts<br>• Gain the usage of Hadoop related tools for Big Data Analytics |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Explain the different types of quantitative data.<br>• Summarize the empirical distribution of data and create simple visualizations.<br>• Illustrate big data platform and explore the big data analytics techniques business applications.<br>• Analyze the HADOOP and Map Reduce technologies associated with big data analytics<br>• Apply Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics. |

| **UNIT-I** | **INTRODUCTION TO BIG DATA** | **9** |
|---|---|---|

Evolution of Big data – Best Practices for Big data Analytics – Big data characteristics – Validating – The Promotion of the Value of Big Data – Big Data Use Cases- Characteristics of Big Data Applications – Perception and Quantification of Value -Understanding Big Data Storage.

| **UNIT-II** | **BIG DATA ANALYTICS** | **9** |
|---|---|---|

Overview of Business Intelligence - Data Science and Analytics - Meaning and Characteristics of big data analytics - Need of big data analytics - Classification of analytics - Challenges to big data analytics - Importance of big data analytics - Basic terminologies in big data environment.

| **UNIT-III** | **BIG DATA TECHNOLOGIES AND DATABASES** | **9** |
|---|---|---|

Introduction to NoSQL - Uses - Features and Types – Need – Advantage - Disadvantages and Application of NoSQL - Overview of NewSQL - Comparing SQL - NoSQL and NewSQL - Introduction to MongoDB and its needs - Characteristics of MongoDB - Introduction of apache cassandra and its needs - Characteristics of Cassandra.

| | | |
|---|---|---|
| **UNIT-IV** | **HADOOP FOUNDATION FOR ANALYTICS AND MAPREDUCE** | **9** |
| History –Features - Key advantage and Versions of Hadoop - Essential of Hadoop ecosystems - RDBMS versus Hadoop - Key aspects and Components of Hadoop - Hadoop architectures - Hadoop MapReduce: Introduction to MapReduce - Processing data with Hadoop using MapReduce. | | |
| **UNIT-V** | **HADOOP RELATED TOOLS** | **9** |
| Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOK :** | |
|---|---|
| 1 | Seema Acharya, Subhashini Chellappan – "Big Data and Analytics", Wiley 2015 Edition. |
| 2 | Minelli, Chambers, Dhiray- "Big Data Big Analytics", John Wiley & Sons, Inc, Copyright 2013. |
| 3 | Eric Sammer, "Hadoop Operations", O'Reilley, 2012. |
| **REFERENCES:** | |
| 1 | Bart Baesens – "Analytics in a Big Data World", John Wiley & Sons, Inc, Copyright 2013 |
| 2 | Boris Lublinsky, Kevin T. Smith – "Hadoop Solutions", Wrox, 1st Edition, Kindle Edition. |
| 3 | Chuck Lam – "Hadoop in Action", Dreamtech- Paperback – 25 Dec 2010. |
| 4 | Ethem Alpaydin – "Introduction to Machine Learning", MIT Press 3rd Edition 2015 |
| 5 | https://nptel.ac.in/courses/106104189/big data computing |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO3** | 3 | 1 | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO5** | 3 | 1 | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 2 | - |
| **Average** | **3** | 2 | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE

**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

**V Semester**

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI14502 | MACHINE LEARNING TECHNIQUES | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to**<br>• Know the concepts of Machine Learning.<br>• Familiarize the supervised learning and their applications.<br>• Gain knowledge about the concepts and algorithms of unsupervised learning.<br>• Understand the theoretical and practical aspects of Probabilistic Graphical Models.<br>• Learn the concepts and algorithms of advanced learning. |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Define a learning model appropriate to the application.<br>• Design a Neural Network for an application of your choice.<br>• Implement Probabilistic Discriminative and Generative algorithms for an application of your choice and analyze theresults.<br>• Apply tool to implement typical Clustering algorithms for different types ofapplications.<br>• Identify applications suitable for different types of Machine Learning with suitable justification. |

| UNIT-I | INTRODUCTION | 9 |
|---|---|---|

Machine Learning–Types and Process of Machine Learning-Machine Learning algorithms, Turning data into Probabilities, and Statistics for Machine Learning- Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.-Probability theory and Distributions – Decision Theory.

| UNIT-II | SUPERVISED LEARNING | 9 |
|---|---|---|

Linear Models for Regression – Linear Models for Classification- – Decision Tree Learning – Bayesian Learning, Naïve Bayes –-Neural Networks-The Perceptron Learning Algorithm, Multi-layer Perceptron, Feed- forward Network, Error Back propagation - Support Vector Machines-Random Forest.

| UNIT-III | UNSUPERVISED LEARNINGAND ENSEMBLE TECHNIQUES | 9 |
|---|---|---|

| | | |
|---|---|---|
| Clustering- K-means – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear Discriminant Analysis, Factor Analysis, Principal Components Analysis, Independent Components Analysis.Ensemble Methods, Bagging, Boosting, Stacking,Sampling-Basic Sampling methods, Monte Carlo, Gibbs Sampling | | |
| **UNIT-IV** | **PROBABILISTIC GRAPHICAL MODELS** | **9** |
| Graphical Models – Undirected Graphical Models – Markov Random Fields – Directed Graphical Models –Bayesian Networks – Conditional Independence properties – Markov Random Fields-Hidden Markov Models – Conditional Random Fields(CRFs),Gradient boosting algorithm and AdaBoosting algorithm. | | |
| **UNIT-V** | **ADVANCED MACHINE LEARNING** | **9** |
| Reinforcement learning – Markov Decision processes,Gaussian Process Regression- Gaussian Process Classification-Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – t test, McNemar's test, K-fold CV paired t test. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOK:** | |
| 1 | Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014. |
| 2 | Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007 |
| **REFERENCES:** | |
| 1 | Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012. |
| 2 | Tom Mitchell, "Machine Learning", McGraw-Hill, 1997. |
| 3 | EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 2 | 1 | - | - | - | - | 3 | 3 | 2 | 2 | 2 | 1 | - |
| **CO2** | 1 | 3 | 3 | 1 | 2 | - | - | - | 2 | 2 | 2 | 1 | 3 | 1 | - |
| **CO3** | 2 | 1 | 3 | 3 | 2 | - | - | - | 1 | 1 | 1 | 1 | 1 | 1 | - |
| **CO4** | 2 | 3 | 3 | 2 | 1 | - | - | - | 3 | 2 | 3 | 2 | 1 | 1 | - |
| **CO5** | 1 | 1 | 3 | 3 | 1 | - | - | - | 3 | 1 | 1 | 3 | 3 | 2 | - |
| **Average** | **2** | 2 | **3** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **2** | **2** | **2** | **1** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

## V Semester

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI24501 | BIG DATA ANALYTICS LABORATORY | 3 | 0 | 0 | 3 | 100 |

**Objective(s)**

**The student should be made to:**

- Know Map Reduce programs for processing big data.
- Realize storage of big data using H base, Mongo DB.
- Analyze big data using linear models.
- Analyze big data using machine learning techniques such as SVM / Decision tree classification and clustering.
- Learn the usage of Hive related tools for Big Data Analytics

**Outcome(s)**

**Upon completion of this course, students will be able to:**

- Process big data using Hadoop framework.
- Build and apply linear and logistic regression models.
- Perform data analysis with machine learning methods.
- Perform graphical data analysis.
- Illustrate and apply different operations on relations and databases using Hive.

## LIST OF EXPERIMENTS

Hadoop

1. To Study of Hadoop installation and HDFS.
2. Implement word count / frequency programs using Map Reduce
3. Implement an MR program that processes a weather dataset

R - Programming

1. Implement Linear and logistic Regression
2. To implement the SVM / Decision tree classification techniques
3. Implement clustering techniques
4. Visualize data using any plotting framework
5. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R.

Hive

1. Installation of Hive along with practice examples.
2. Practice importing and exporting data from various databases.

| TOTAL HOURS | 30 |
|---|---|

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 3 | 3 | - | - | - | - | 1 | 1 | 2 | 1 | 3 | 3 | - |
| **CO2** | 1 | 2 | 3 | 3 | - | - | - | - | 3 | 2 | 3 | 3 | 3 | 3 | - |
| **CO3** | 3 | 1 | 3 | 3 | - | 2 | - | - | 1 | 3 | 1 | 2 | 3 | 3 | - |
| **CO4** | 2 | 1 | 1 | 1 | - | - | - | - | 2 | 3 | 1 | 2 | 3 | 2 | - |
| **CO5** | 3 | 1 | 1 | 1 | - | - | - | - | 1 | 3 | 3 | 3 | 2 | 3 | - |
| **Average** | **3** | 1 | **2** | **2** | **-** | **-** | **-** | **-** | **2** | **2** | **2** | **2** | **3** | **2.8** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE

**(Autonomous)**

## Syllabus

| **Department** | **Artificial Intelligence And Data Science** | **Programme Code & Name** | **1161** |
|---|---|---|---|

**V Semester**

| **Course Code** | **Course Name** | **Hours/Week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22AI24502** | **MACHINE LEARNING TECHNIQUES LABORATORY** | **0** | **0** | **4** | **2** | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to**<br>• Apply the concepts of Machine Learning to solve real-worldproblems.<br>• Implement basic algorithms in clustering & classification applied to text & numeric data.<br>• Implement algorithms emphasizing the importance of bagging & boosting in classification &regression.<br>• Implement algorithms related to dimensionalityreduction.<br>• Apply machine learning algorithms for Natural Language Processingapplications. |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Learn to use Weka tool for implementing machine learning algorithms related to numeric data.<br>• Learn the application of machine learning algorithms for textdata.<br>• Use dimensionality reduction algorithms for image processingapplications.<br>• Apply crfs in text processingapplications.<br>• Use fundamental and advanced neural network algorithms for solving real-worlddata. |

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Solving Regression & Classification using Decision Trees |
| 2. | Root Node Attribute Selection for Decision Trees using InformationGain |
| 3. | Bayesian Inference in Gene ExpressionAnalysis |
| 4. | Pattern Recognition Application using BayesianInference |
| 5. | Bagging inClassification and Boosting applications using RegressionTrees |
| 6. | Non-parametric Locally Weighted Regression algorithm in order to fit datapoints. |
| 7. | Data & Text Classification using NeuralNetworks |
| 8. | Using Weka tool for SVM classification for chosen domainapplication |
| 9. | Data & Text Clustering using K-meansalgorithm and Gaussian MixtureModels |
| 10. | Build the graph based learning models for standard data sets. |

| | |
|---|---|
| | |
| **TOTAL HOURS** | **30** |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 | 3 | 3 | 2 | - |
| **CO2** | 2 | 1 | 1 | 3 | 2 | - | - | - | - | 2 | 3 | 2 | 3 | 1 | - |
| **CO3** | 2 | 2 | 1 | 1 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | 3 | - |
| **CO4** | 2 | 2 | 3 | 3 | 2 | - | - | - | - | 2 | 1 | 1 | 1 | 1 | - |
| **CO5** | 2 | 2 | 3 | 1 | 2 | - | - | - | - | 2 | 1 | 1 | 2 | 2 | - |
| **Average** | **2** | 2 | **2** | **2** | **2** | **-** | **-** | **-** | **-** | **2** | **2** | **2** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

**Regulations 2022**

**VI Semester**

| Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|
| **THEORY** | | | | | | |
| | Managerial Skills, Project and Quality Management | 3 | 0 | 0 | 3 | HS |
| 22AI14601 | Deep Learning | 3 | 0 | 0 | 3 | PC |
| 22AI14602 | Natural Language Processing | 3 | 0 | 0 | 3 | PC |
| 22AI14603 | Healthcare Analytics | 3 | 0 | 0 | 3 | PC |
| | Program Elective-3 | 3 | 0 | 0 | 3 | PE |
| | Open Elective-5 | 3 | 0 | 0 | 3 | OE |
| **PRACTICAL** | | | | | | |
| 22AI24601 | Deep Learning Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 22AI24602 | Natural Language Processing Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 22AI26601 | Mini Project | 0 | 0 | 6 | 3 | EEC |
| | **TOTAL** | **18** | **0** | **12** | **24** | |
| | | | | | | |

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

**VI Semester**

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI14601 | DEEP LEARNING | 3 | 0 | 0 | 3 | 100 |

**Objective(s)**

**The student should be made to:**

- Learn the principles of deep neural networks
- Gain CNN and RNN architectures of deep neural networks
- Comprehend advanced deep learning models
- Learn the evaluation metrics for deep learning models
- Gain the basics of deep neural networks

**Outcome(s)**

**Upon completion of this course , students will be able to :**

- Explain the basics in deep neural networks
- Apply Convolution Neural Network for image processing
- Apply Recurrent Neural Network and its variants for text analysis
- Apply model evaluation for various applications
- Apply autoencoders and generative models for suitable applications

| UNIT-I | DEEP NETWORKS BASICS | 9 |
|---|---|---|

Linear Algebra: Scalars -Vectors - Matrices and tensors; Probability Distributions - Gradientbased Optimization – Machine Learning Basics: Capacity - Overfitting and underfitting - Hyperparameters and validation sets - Estimators - Bias and variance - Stochastic gradient descent - Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization - Optimization.

| UNIT-II | CONVOLUTIONAL NEURAL NETWORKS | 9 |
|---|---|---|

Convolution Operation - Sparse Interactions -Parameter Sharing -- Equivariance - Pooling - Convolution Variants: Strided - Tiled - Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions - Loss Functions - Regularization - Optimizers-Gradient Computation.

| UNIT-III | RECURRENT NEURAL NETWORKS | 9 |
|---|---|---|

Unfolding Graphs - RNN Design Patterns: Acceptor - Encoder -Transducer; Gradient Computation - Sequence Modeling Conditioned on Contexts - Bidirectional RNN - Sequence to Sequence RNN – Deep Recurrent Networks - Recursive Neural Networks -Long Term Dependencies; Leaky Units: Skip connections and dropouts; Gated Architecture: LSTM.

| UNIT-IV | MODEL EVALUATION | 9 |
|---|---|---|

| | | |
|---|---|---|
| Performance metrics - Baseline Models - Hyperparameters: Manual Hyperparameter - Automatic Hyperparameter - Grid search - Random search - Debugging strategies. | | |
| **UNIT-V** | **AUTOENCODERS AND GENERATIVE MODELS** | 9 |
| Autoencoders: Undercomplete autoencoders - Regularized autoencoders - Stochastic encoders and decoders - Learning with autoencoders; Deep Generative Models: Variational autoencoders – Generative adversarial networks. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS :** | |
| 1 | Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning", MIT Press, 2016. |
| 2 | Andrew Glassner, “Deep Learning: A Visual Approach”, No Starch Press, 2021. |
| **REFERENCES:** | |
| 3 | Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, ``A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018. |
| 4 | Yoav Goldberg, ``Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017 |
| 5 | Francois Chollet, ``Deep Learning with Python", Manning Publications Co, 2018 |
| 6 | Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018 |
| | Josh Patterson, Adam Gibson, ``Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | 1 | - | - | - | 2 | 1 | 3 | 1 | 3 | 1 | - |
| **CO2** | 2 | 2 | 2 | 3 | 3 | - | - | - | 1 | 2 | 2 | 1 | 3 | 1 | - |
| **CO3** | 3 | 3 | 3 | 3 | 3 | - | - | - | 2 | 3 | 1 | 2 | 1 | 1 | - |
| **CO4** | 3 | 3 | 1 | 1 | 1 | - | - | - | 1 | 2 | 1 | 1 | 1 | 1 | - |
| **CO5** | 3 | 2 | 2 | 2 | 3 | - | - | - | 2 | 2 | 2 | 2 | 2 | 2 | - |
| **Average** | **3** | 2 | **2** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **2** | **1** | **2** | **1** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

<table>
<tr><td colspan="7">MAHENDRA ENGINEERING COLLEGE<br>(Autonomous)</td></tr>
<tr><td colspan="7">Syllabus</td></tr>
<tr><td>Department</td><td colspan="2">Artificial Intelligence And Data Science</td><td colspan="2">Programme Code</td><td colspan="2">1161</td></tr>
<tr><td colspan="7">VI Semester</td></tr>
<tr><td>Course code</td><td>Course Name</td><td colspan="3">Hours/week</td><td>Credit</td><td>Maximum marks</td></tr>
<tr><td rowspan="2">22AI14602</td><td rowspan="2">NATURAL LANGUAGE PROCESSING</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Objective(s)</td><td colspan="6">The student should be made to:<br>• Learn the fundamentals of natural language processing<br>• Gain knowledge in current methods for statistical approaches to machine translation<br>• Understand the use of CFG and PCFG in NLP<br>• Know the role of semantics of sentences and pragmatics<br>• Be exposed with the NLP techniques to IR applications</td></tr>
<tr><td>Outcome(s)</td><td colspan="6">Upon completion of the course, the students should be able to:<br>• Elaborate tag in a given text with basic Language features<br>• Design an innovative application using NLP components<br>• Implement a rule based system to tackle morphology/syntax of a language<br>• Create a tag set to be used for statistical processing for real-time applications<br>• Compare and contrast the use of different statistical approaches for different types of NLP applications.</td></tr>
<tr><td>UNIT-I</td><td colspan="5">INTRODUCTION</td><td>9</td></tr>
<tr><td colspan="7">Introduction- Phases of NLP-Challenges of NLP, Language Modeling: Grammar-based LM, Statistical LM -Regular Expressions, Finite-State Automata – English Morphology, Finite state Transducer, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.</td></tr>
<tr><td>UNIT-II</td><td colspan="5">WORD LEVEL ANALYSIS</td><td>9</td></tr>
<tr><td colspan="7">Unsmoothed N-grams, Evaluating N-grams, Smoothing, Laplace Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.</td></tr>
<tr><td>UNIT-III</td><td colspan="5">SYNTACTIC ANALYSIS</td><td>9</td></tr>
<tr><td colspan="7">Context-Free Grammars, Grammar rules for English, Dependency Parsing: Dependency Grammar, Graph-based dependency parsing – Syntactic Parsing, Ambiguity, Normal Forms for grammar, CYK algorithm – Dynamic Programming parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.</td></tr>
<tr><td>UNIT-IV</td><td colspan="5">SEMANTICS ANALYSIS AND DISCOURSE PROCESSING</td><td>9</td></tr>
</table>

| | | |
|---|---|---|
| Semantic representation, First-Order Logic– Syntax-Driven Semantic analysis, Semantic attachments – Lexical Semantics, Sense ambiguity, Word Sense Disambiguation, Discourse Processing: cohesion-Reference Resolution, Discourse Coherence and Structure. | | |
| **UNIT-V** | **LEXICAL RESOURCES** | 9 |
| Understanding Lexical resources, Resources: Tokenization, Stop Words, Chunking, Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, Word Net, FrameNet, Prop Bank, Brown Corpus, Word vectors, Doc2vec, Word2vec. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014. |
| 2 | Steven Bird, Ewan Klein and Edward Loper, ―Natural Language Processing with Python‖, First Edition, O_Reilly Media, 2009. |
| **REFERENCES:** | |
| 1 | Breck Baldwin, ―Language Processing with Java and Ling Pipe Cookbook, Atlantic Publisher, 2015. |
| 2 | Richard M Reese, ―Natural Language Processing with Java‖, O_Reilly Media, 2015. |
| 3 | Nitin Indurkhya and Fred J. Damerau, ―Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010. |
| 4 | Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval‖, Oxford University Press, 2008. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | 3 | - | - | - | 1 | 2 | 3 | 1 | 3 | 1 | - |
| **CO2** | 3 | 1 | 2 | 1 | 3 | - | - | - | 2 | 2 | 2 | 2 | 3 | 2 | - |
| **CO3** | 2 | 2 | 1 | 3 | 1 | 2 | - | - | 3 | 3 | 1 | 2 | 1 | 3 | - |
| **CO4** | 2 | 1 | 1 | 1 | 2 | - | - | - | 3 | 2 | 2 | 1 | 1 | 1 | - |
| **CO5** | 1 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 2 | 2 | 2 | 3 | - |
| **Average** | **2** | 2 | **2** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **2** | **2** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE

**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

## VI Semester

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI14603 | HEALTHCARE ANALYTICS | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Learn the fundamentals of Healthcare Analytics<br>• Gain knowledge in current methods For Healthcare Image And Text Data Analytics<br>• Understand the Concepts of Biomedical image and Text Data Analytics<br>• Know the role of Clinical Prediction Models<br>• Be exposed with the Temporal And Visual Data Analytics |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Discuss about the various healthcare data sources and the analytical techniques.<br>• Perform medical image and text data analysis.<br>• Enumerate the concept of biomedical text mining and social media healthcare analytics<br>• Apply prediction models for healthcare data and perform evaluation.<br>• Summarize temporal data mining and visualization techniques for healthcare data. |

| UNIT-I | HEALTHCARE ANALYTICS AND DATA SOURCES | 9 |
|---|---|---|

Introduction to Healthcare Data Analytics:Introduction– Healthcare Data Sources and Basic Analytics– Advanced Data Analytics for Healthcare-Applications and practical systems for Healthcare – Resources for healthcare data analytics. Electronic Health Records: Introduction– History- Components– Coding Systems – Benefits- Barrier– Challenges– Phenotyping Algorithms.

| UNIT-II | HEALTHCARE IMAGE AND TEXT DATA ANALYTICS | 9 |
|---|---|---|

Biomedical Image Analysis: Introduction– Modalities– Object Detection– Image Segmentation– Image Registration– Feature Extraction. Natural Language Processing:Introduction– Natural Language Processing– Mining Information from Clinical Text– Challenges of Processing Clinical Reports– Clinical Applications.

| UNIT-III | BIOMEDICAL AND SOCIAL MEDIA DATA ANALYTICS | 9 |
|---|---|---|

| | | |
|---|---|---|
| Mining the Biomedical Literature: Introduction-Resources– Terminology Acquisition and Management– Information Extraction-Discourse Interpretation– Text Mining Environments– Applications– Integration with Clinical Text Mining. Social Media Analytics for Healthcare:Introduction– Detection and Tracking of Infectious Disease– Public Health Research–Use in Healthcare. | | |
| **UNIT-IV** | **CLINICAL PREDICTION MODELS** | 9 |
| Review of Clinical Prediction Models: Introduction– Basic Statistical Prediction Models: Linear Regression– Generative Additive Model- Logistic Regression– Bayesian Models- Markov Random Fields– Alternative Clinical Prediction Models– Survival Models- Evaluation and Validation: Evaluation Metrics– Validation. | | |
| **UNIT-V** | **TEMPORAL AND VISUAL DATA ANALYTICS** | 9 |
| Temporal Data Mining for Healthcare Data:Introduction– Association Analysis– Temporal Pattern Mining– Sensor Data Analysis- Other Temporal Modeling Methods– Resources.Visual Analytics for Healthcare: Introduction to Visual Analytics and Medical Data Visualization– Visual Analytics in Healthcare. | | |
| | **TOTAL HOURS** | **45** |

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

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | 1 | - | - | - | - | - | 2 | 3 | 3 | 3 | 2 | - |
| **CO2** | 2 | 1 | 1 | 3 | 2 | - | - | - | - | 2 | 3 | 2 | 3 | 1 | - |
| **CO3** | 2 | 2 | 1 | 1 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | 3 | - |
| **CO4** | 2 | 2 | 3 | 3 | 2 | - | - | - | - | 2 | 1 | 1 | 1 | 1 | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO5** | 2 | 2 | 3 | 1 | 2 | - | - | - | - | 2 | 1 | 1 | 2 | 2 | - |
| **Average** | **2** | 2 | **2** | **2** | **2** | - | - | - | - | **2** | **2** | **2** | **2** | **2** | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| **MAHENDRA ENGINEERING COLLEGE** (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence And Data Science** | | **Programme Code & Name** | | | **1161** |
| **VI Semester** | | | | | | |
| **Course Code** | **Course Name** | **Hours /Week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI24601** | **DEEP LEARNING LABORATORY** | **0** | **0** | **4** | **2** | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Learn the basics of deep neural networks<br>• Familarize the tools and techniques to implement deep neural networks<br>• Learn different deep learning architectures for solving problems<br>• Familier with generative models for suitable applications<br>• Learn to build and validate different models | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Apply deep neural network for simple problems<br>• Apply Convolution Neural Network for image processing<br>• Apply Recurrent Neural Network and its variants for text analysis<br>• Apply generative models for data augmentation<br>• Develop real-world solutions using suitable deep neural networks | | | | | |

**LIST OF EXPERIMENTS**

| | |
|---|---|
| 1. | Solving XOR problem using DNN |
| 2. | Character recognition using CNN |
| 3. | Face recognition using CNN |
| 4. | Language modeling using RNN |
| 5. | Sentiment analysis using LSTM |
| 6. | Parts of speech tagging using Sequence to Sequence architecture |
| 7. | Machine Translation using Encoder-Decoder model |
| 8. | Image augmentation using GANs |
| 9. | Mini-project on real world applications |

| | | |
|---|---|---|
| | **TOTAL HOURS** | **30** |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 1 | 3 | - | - | - | - | 1 | 1 | 3 | 1 | 3 | 3 | - |
| **CO2** | 3 | 2 | 1 | 3 | 2 | - | - | - | 2 | 2 | 2 | 1 | 3 | 3 | - |
| **CO3** | 3 | 2 | 3 | 2 | 1 | 2 | - | - | 3 | 3 | 1 | 2 | 1 | 3 | - |
| **CO4** | 2 | 3 | 1 | 3 | 1 | - | - | - | 1 | 2 | 1 | 1 | 1 | 3 | - |
| **CO5** | 2 | 3 | 1 | 3 | 2 | - | - | - | 2 | 2 | 2 | 2 | 2 | 2 | - |
| **Average** | **3** | 2 | **2** | **3** | **2** | **-** | **-** | **-** | **2** | **2** | **2** | **1** | **2** | **3** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

## VII Semester

| Course Code | Course Name | Hours/Week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI24602 | NATURAL LANGUAGE PROCESSING LABORATORY | 0 | 0 | 3 | 2 | 100 |

**Objective(s):**

**The student should be made to:**

- Learn linguistic phenomena and linguistic features relevant to each NLP task
- Have a basic knowledge in NLP tools like classifiers, translators, pos taggers, stemmers for Indian and other languages
- Familiar with the use of modern NLP techniques for processing of text.
- Know the basic of an innovative application using NLP components.
- Learn the Machine Translation Program

**Outcome(s):**

**Upon completion of this course, students will be able to:**

- Develop NLP programs in Python.
- Demonstrate the use of modern NLP techniques for processing of text.
- Implement Data structures and algorithms used in NLP.
- Implement NLP tools like classifiers, translators, pos taggers & stemmers for Indian and other languages
- Develop a Program for Machine Translation

## LIST OF EXPERIMENTS

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

| | |
|---|---|
| 1 | Construct a program for text pre-processing |
| 2 | Develop a program for finding word frequencies in a text |
| 3 | Create a program for text classification |
| 4 | Develop a program for Morphological Analysis |
| 5 | Create a program for stemming and Chunking |
| 6 | Develop a program for feature structures |
| 7 | Implement a program for POS Tagging |
| 8 | Implement a program for parsing |
| 9 | Develop a program for language modeling |
| 10 | Implement a program for machine translation |
| | **TOTAL HOURS** **30** |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | - | - | - | - | 1 | 1 | 3 | 1 | 3 | 1 | - |
| **CO2** | 3 | 2 | 2 | 3 | 2 | - | - | - | 2 | 2 | 2 | 1 | 3 | 2 | - |
| **CO3** | 3 | 3 | 3 | 3 | 1 | 2 | - | - | 3 | 2 | 2 | 2 | 1 | 1 | - |
| **CO4** | 2 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 1 | 2 | 1 | 3 | - |
| **CO5** | 3 | 3 | 1 | 1 | 2 | - | - | - | 2 | 2 | 2 | 2 | 2 | 2 | - |
| **Average** | **3** | 3 | **2** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **2** | **1** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

**Regulations 2022**

## VII Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | 22AI14701 | Computer Vision | 3 | 0 | 0 | 3 | PC |
| 2 | 22AI14702 | Data Security | 3 | 0 | 0 | 3 | PC |
| 3 | 22AI14703 | Reinforcement Learning Algorithms | 3 | 0 | 0 | 3 | PC |
| 4 | 22AI14704 | Text And Speech Analytics | 3 | 0 | 0 | 3 | PC |
| 5 | | Program Elective – 4 | 3 | 0 | 0 | 3 | PE |
| 6 | | (Open Elective-6) | 3 | 0 | 0 | 3 | OE |
| | **PRACTICAL** | | | | | | |
| 7 | 22AI24701 | Computer Vision Laboratory | 0 | 0 | 3 | 1.5 | PC |
| 8 | 22AI26703 | Internship in Industry | - | - | - | 1 | EEC |
| | | **TOTAL** | **15** | **0** | **3** | **20.5** | |

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

## VII Semester

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI14701 | COMPUTER VISION | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Learn the fundamental concepts related to Image formation and processing.<br>• Learn feature detection, matching and detection<br>• Become familiar with feature based alignment and motion estimation<br>• Develop skills on 3D reconstruction<br>• Learn image based rendering and recognition |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Explain the theories and methods in image processing and computer vision.<br>• Implement the some advanced image processing techniques<br>• Apply 2D a feature-based based image alignment, segmentation and motion estimations.<br>• Apply 3D image reconstruction techniques<br>• Design and develop innovative image processing and computer vision applications. |

| | | |
|---|---|---|
| **UNIT-I** | **INTRODUCTION TO IMAGE FORMATION AND PROCESSING** | 9 |

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization

| | | |
|---|---|---|
| **UNIT-II** | **FEATURE DETECTION, MATCHING AND SEGMENTATION** | 9 |

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge – Mean - shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

| | | |
|---|---|---|
| **UNIT-III** | **FEATURE-BASED ALIGNMENT & MOTION ESTIMATION** | 9 |

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

| | | |
|---|---|---|
| **UNIT-IV** | **3D RECONSTRUCTION** | 9 |

Shape from X - Active rangefinding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

| | | |
|---|---|---|
| **UNIT-V** | **IMAGE-BASED RENDERING AND RECOGNITION** | 9 |
| View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS :** | |
| 1 | Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022. |
| 2 | Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015. |
| **REFERENCES:** | |
| 1 | Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004. |
| 2 | Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006 |
| 3 | E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 1 | 1 | 1 | - | - | - | 2 | 1 | 3 | 2 | 2 | 1 | - |
| **CO2** | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | 1 | 2 | 2 | 3 | 1 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | - | - | - | 1 | 1 | 2 | 2 | 3 | 2 | - |
| **CO4** | 2 | 3 | 3 | 2 | 3 | - | - | - | 2 | 1 | 2 | 3 | 2 | 2 | - |
| **CO5** | 2 | 3 | 3 | 2 | 2 | - | - | - | 3 | 1 | 2 | 3 | 3 | 3 | - |
| **Average** | **3** | 3 | **3** | **2** | **2** | **-** | **-** | **-** | **2** | **1** | **2** | **2** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

## VII Semester

| Course code | Course Name | Hourss/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI14702 | DATA SECURITY | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Learn the fundamental concepts related to Data Security<br>• Know the legal, ethical and professional issues in Information Security<br>• Become familiar with Digital Signature and Authentication<br>• Equip the students' knowledge on digital signature<br>• Gain the fundamental concepts of email security and web security |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Identify the concepts of data and information security<br>• Discuss the legal, ethical and professional issues in information security<br>• Discribe the various authentication schemes to simulate different applications.<br>• Apply various security practices and system security standards<br>• Apply the Web security protocols for E-Commerce application |

| | | |
|---|---|---|
| **UNIT-I** | **INTRODUCTION TO IMAGE FORMATION AND PROCESSING** | 9 |

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

| | | |
|---|---|---|
| **UNIT-II** | **SECURITY INVESTIGATION** | 9 |

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

| | | |
|---|---|---|
| **UNIT-III** | **DIGITAL SIGNATURE AND AUTHENTICATION** | 9 |

Digital Signature and Authentication Schemes: Digital signature-Digital Signature Schemes and their Variants- Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos -X.509 Directory Services

| | | |
|---|---|---|
| **UNIT-IV** | **E-MAIL AND IP SECURITY** | 9 |

| | | |
|---|---|---|
| E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPSec Modes – Security association - Key management | | |
| **UNIT-V** | **WEB SECURITY** | 9 |
| Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure communication- Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS :** | |
| 1 | Michael E Whitman and Herbert J Mattord, "Principles of Information Security, Course Technology, 6th Edition, 2017 |
| 2 | Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2017. |
| **REFERENCES:** | |
| 1 | Harold F. Tipton, Micki Krause Nozaki,, "Information Security Management Handbook, Volume 6, 6th Edition, 2016. |
| 2 | Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", McGraw- Hill, Seventh Edition, 2012 |
| 3 | Matt Bishop, "Computer Security Art and Science, Addison Wesley Reprint Edition, 2015 |
| 4 | Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography And network security, 3rd Edition, . McGraw-Hill Education, 2015 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | - | - | - | - | 1 | 3 | 1 | 2 | 3 | 1 | - |
| **CO2** | 1 | 3 | 3 | 3 | 2 | - | - | - | 1 | 2 | 2 | 2 | 2 | 1 | - |
| **CO3** | 2 | 3 | 3 | 3 | 1 | - | - | - | 1 | 3 | 1 | 2 | 1 | 2 | - |
| **CO4** | 2 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 1 | 2 | 1 | 3 | - |
| **CO5** | 3 | 3 | 1 | 1 | 2 | - | - | - | 2 | 2 | 2 | 2 | 2 | 2 | - |
| **Average** | **3** | 3 | **2** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **2** | **1** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence And Data Science | Programme Code | 1161 |
|---|---|---|---|

**VII Semester**

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI14703 | REINFORCEMENT LEARNING | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **he student should be made to:**<br>• Investigate the key concepts of knowledge representation(KR) techniques and different notations.<br>• Integrate the KR view as a knowledge eengineering approach to model organizational knowledge.<br>• Introduce the study of ontologies as a K R paradigm and applications of ontologies.<br>• Learn various KR techniques.<br>• Gain process,knowledge acquisition and sharing of ontology.. |
| **Outcome(s)** | **Upon completion of this course , students will be able to:**<br>• Illustrate RL tasks and the core principles behind the RL<br>• Apply tabular methods to solve classical control problems<br>• Utilize Markov decision process in optimization of complex problems<br>• Solve problems using dynamic programming and Monte-Carlo methods<br>• outline temporal-difference learning and Q-learning |

| **UNIT-I** | **INTRODUCTION AND BASICS OF RL** | 9 |
|---|---|---|

Reinforcement Learning- Examples- Elements of Reinforcement Learning- Limitations and Scope- An Extended Example: Tic-Tac-Toe- History of Reinforcement Learning.

| **UNIT-II** | **TABULAR SOLUTION METHODS** | 9 |
|---|---|---|

Multi-arm Bandits - An n-Armed Bandit Problem- Action-Value Methods- Incremental Implementation- Tracking a Nonstationary Problem- Optimistic Initial Values- Upper-Confidence-Bound Action Selection- Gradient Bandit- Associative Search.

| **UNIT-III** | **FINITE MARKOV DECISION PROCESSES** | 9 |
|---|---|---|

The Agent–Environment Interface- Goals and Rewards- Returns- Unified Notation for Episodic and Continuing Tasks- The Markov Property- Markov Decision Processes- Value Functions- Optimal Value Functions- Optimality and Approximation.

| **UNIT-IV** | **DYNAMIC PROGRAMMING AND MONTE CARLO METHODS** | 9 |
|---|---|---|

| | | |
|---|---|---|
| Dynamic Programming - Policy Evaluation- Policy Improvement- Policy Iteration- Value Iteration- Generalized Policy Iteration. Monte Carlo Methods: Monte Carlo Prediction- Monte Carlo Estimation of Action Values- Monte Carlo Control- Monte Carlo Control without Exploring Starts. | | |
| **UNIT-V** | **TEMPORAL-DIFFERENCE LEARNING** | 9 |
| TD Prediction- Advantages of TD Prediction Methods- Optimality of TD(0) -Sarsa: On-Policy TD Control- Q-Learning: Off-Policy TD Control- Games, After states, and Other Special Cases | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS :** | |
|---|---|
| 1 | Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning: An Introduction", 2nd Edition, MIT Press, London, 2018. |

| **REFERENCES:** | |
|---|---|
| 1. | Phill winder, “Reinforcement Learning: Industrial applications of intelligent agents", 1st Edition, O'Reilly Media, 2020. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 1 | 1 | 1 | - | - | - | 2 | 1 | 3 | 2 | 2 | 1 | - |
| **CO2** | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | 1 | 2 | 2 | 3 | 1 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | - | - | - | 1 | 1 | 2 | 2 | 3 | 2 | - |
| **CO4** | 2 | 3 | 3 | 2 | 3 | - | - | - | 2 | 1 | 2 | 3 | 2 | 2 | - |
| **CO5** | 2 | 3 | 3 | 2 | 2 | - | - | - | 3 | 1 | 2 | 3 | 3 | 3 | - |
| **Average** | **3** | 3 | **3** | **2** | **2** | **-** | **-** | **-** | **2** | **1** | **2** | **2** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, ‘-“- No Correlation**

# MAHENDRA ENGINEERING COLLEGE

**(Autonomous)**

## Syllabus

| **Department** | **Artificial Intelligence And Data Science** | **Programme Code** | **1161** |
|---|---|---|---|

## VII Semester

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22AI14704** | **TEXT AND SPEECH ANALYTICS** | 3 | 0 | 0 | 3 | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Learn the fundamentals of natural language processing<br>• Gain knowledge in current methods for Text Processing<br>• Understand the use of Text Classification<br>• Know the role of Text Summarization<br>• Be exposed with the Speech Analytics |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Explore various text extraction techniques<br>• Apply various text processing techniques<br>• Build text classification model<br>• Perform automatic text summarization<br>• Discuss about speech processing techniques |

| **UNIT-I** | **INTRODUCTION TO NLP** | 9 |
|---|---|---|

Introduction- Natural Language - Language Acquisition and usage - Language Syntax and Structure - Language Semantics - Lexical Semantic Relations - SemanticsRepresentation - Text Corpora - Accessing Text Corpora - Natural Language Processing – Text Analytics

| **UNIT-II** | **TEXT PROCESSING** | 9 |
|---|---|---|

Processing and Understanding Text - Text Tokenization - Text Normalization- Correcting Words – Stemming – Lemmatization- Text Syntax and Structure - POS Tagging - Shallow Parsing – Dependency-based Parsing- Constituency based Phrasing

| **UNIT-III** | **TEXT CLASSIFICATION** | 9 |
|---|---|---|

Introduction – Automated Text classification - Text classification Blue Print- Text Normalization – Feature Extraction -Classification Algorithm - Application and uses

| **UNIT-IV** | **TEXT SUMMARIZATION** | 9 |
|---|---|---|

Text Summarization -Key Phrase Extraction - Topic Modeling - Automated Document Summarization - Text Similarity and Clustering - Analyzing Term Similarity - Analyzing Document Similarity

| **UNIT-V** | **SPEECH ANALYTICS** | 9 |
|---|---|---|

| | |
|---|---|
| Introduction-Python Speech Recognition Package-Installing Speech Recognition- The Recognizer Class-Working with Audio Files - Working with Microphones | |
| **TOTAL HOURS** | **45** |

| **TEXT BOOKS:** | |
|---|---|
| 1 | DipanjanSarkar,"Text Analytics with Python: A Practical Real-World Approach to Gaining Actionable Insights from your Data", 1st Edition, APress publication, 2016 for Units 1,2,3 and 4. |
| 2 | https://realpython.com/python-speech-recognition/#supported-file-types for Unit 5. |
| **REFERENCES:** | |
| 1 | Michael W. Berry & Jacob Kogan,"Text Mining Applications and Theory", Wiley publications, 2010 |
| 2 | Jurafsky and Martin, "Speech and Language Processing", 2nd Edition, Pearson Prentice Hall, 2008 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | 3 | - | - | - | 1 | 2 | 1 | 2 | 1 | 1 | - |
| **CO2** | 3 | 1 | 2 | 1 | 3 | - | - | - | 2 | 2 | 1 | 3 | 3 | 2 | - |
| **CO3** | 2 | 2 | 1 | 3 | 1 | - | - | - | 2 | 2 | 1 | 3 | 2 | 2 | - |
| **CO4** | 2 | 1 | 1 | 1 | 2 | - | - | - | 2 | 1 | 2 | 2 | 3 | 1 | - |
| **CO5** | 1 | 3 | 2 | 2 | 1 | - | - | - | 3 | 2 | 1 | 1 | 2 | 3 | - |
| **Average** | **2** | 2 | **2** | **2** | **2** | **-** | **-** | **-** | **2** | **1** | **2** | **2** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence And Data Science** | **Programme Code & Name** | | | | **1161** |
| **VII Semester** | | | | | | |
| **Course Code** | **Course Name** | **Hours /Week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI24701** | **COMPUTER VISION LABORATORY** | **0** | **0** | **3** | **1.5** | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Introduce students the fundamentals of image formation<br>• Introduce students the major ideas, methods, and techniques of computer vision and pattern recognition;<br>• Develop an appreciation for various issues in the design of computer vision and object recognition systems<br>• Provide the student with programming experience from implementing computer vision and object recognition applications.<br>• Implement the various image related packagesusing OpenCV | | | | | |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Identify basic concepts, terminology, theories, models and methods in the field of computer vision<br>• Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition<br>• Apply chain codes and other region descriptors.<br>• Apply Hough Transform for line, circle, and ellipse detections.<br>• Implement motion related techniques | | | | | |

| **LISTOF EXPERIMENTS** | |
|---|---|
| 1 | Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contour analysis, Bolb detection |
| 2 | Image Annotation – Drawing lines, text circle, rectangle, ellipse on images |
| 3 | Image Enhancement - Understanding Color spaces, color space conversion, Histogram equialization, Convolution, Image smoothing, Gradients, Edge Detection |
| 4 | Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORB Image features, Feature matching, cloning, Feature matching based image alignment |
| 5 | Image segmentation using Graphcut / Grabcut |
| 6 | Camera Calibration with circular grid |
| 7 | Pose Estimation |
| 8 | 3D Reconstruction – Creating Depth map from stereo images |

| | | |
|---|---|---|
| 9 | Object Detection and Tracking using Kalman Filter, Camshift | |
| | **TOTAL HOURS** | **30** |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 2 | 2 | - | - | - | 3 | 3 | 2 | 1 | 2 | 1 | - |
| **CO2** | 2 | 2 | 3 | 3 | 3 | - | - | - | 3 | 2 | 1 | 1 | 2 | 2 | - |
| **CO3** | 1 | 2 | 2 | 2 | 3 | - | - | - | 1 | 2 | 1 | 2 | 1 | 1 | - |
| **CO4** | 1 | 2 | 3 | 2 | 3 | - | - | - | 2 | 2 | 2 | 3 | 2 | 2 | - |
| **CO5** | 3 | 2 | 1 | 3 | 2 | - | - | - | 2 | 1 | 1 | 3 | 3 | 2 | - |
| **Average** | **2** | 1.8 | **2.2** | **2.4** | **2.6** | **-** | **-** | **-** | **2.2** | **2** | **1.4** | **2** | **2** | **1.6** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulations 2022**

## VIII Semester

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-Gory |
|---|---|---|---|---|---|---|---|
| | **THEORY** | | | | | | |
| 1 | | Program Elective – 5 | 3 | 0 | 0 | 3 | PE |
| 2 | | Program Elective – 6 | 3 | 0 | 0 | 3 | PE |
| | **PRACTICAL** | | | | | | |
| 3 | 22AI26801 | Project Work | 0 | 0 | 12 | 6 | PCP |
| | | **TOTAL** | **6** | **0** | **12** | **12** | |

## POGRAM ELECTIVES (PE)

**MAHENDRA ENGINEERING COLLEGE**
**(Autonomous)**

**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

**Regulation 2022**

**NETWORKING**

| Sl. No. | Course code | Course Title | L | T | P | C | Cate-gory |
|---|---|---|---|---|---|---|---|
| 1 | 22AI15001 | Information Storage and Management | 3 | 0 | 0 | 3 | PE |
| 2 | 22AI15002 | Computer Networks | 3 | 0 | 0 | 3 | PE |
| 3 | 22AI15003 | Social Network Analysis | 3 | 0 | 0 | 3 | PE |
| 4 | 22AI15004 | Information Security | 3 | 0 | 0 | 3 | PE |
| 5 | 22AI15005 | Software Defined Networks | 3 | 0 | 0 | 3 | PE |
| 6 | 22AI15006 | Network Management | 3 | 0 | 0 | 3 | PE |
| 7 | 22AI15007 | Artificial Neural Networks | 3 | 0 | 0 | 3 | PE |
| **COPUTING TECHNIQUES** | | | | | | | |
| 8 | 22AI15008 | Introduction To IOT | 3 | 0 | 0 | 3 | PE |
| 9 | 22AI15009 | Cloud Computing | 3 | 0 | 0 | 3 | PE |
| 10 | 22AI15010 | Multi-Core Computing | 3 | 0 | 0 | 3 | PE |
| 11 | 22AI15011 | Distributed Computing | 3 | 0 | 0 | 3 | PE |
| 12 | 22AI15012 | Virtualization Techniques | 3 | 0 | 0 | 3 | PE |
| 13 | 22AI15013 | Game Programming | 3 | 0 | 0 | 3 | PE |
| 14 | 22AI15014 | Graph Theory And Applications | 3 | 0 | 0 | 3 | PE |
| **APPLICATION DEVELOPMENT** | | | | | | | |
| 15 | 22AI15015 | Open Source Software | 3 | 0 | 0 | 3 | PE |
| 16 | 22AI15016 | Image Processing | 3 | 0 | 0 | 3 | PE |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17 | 22AI15017 | Healthcare Informatics | 3 | 0 | 0 | 3 | PE |
| 18 | 22AI15018 | Block Chain Technology | 3 | 0 | 0 | 3 | PE |
| 19 | 22AI15019 | Object Oriented Analysis and Design | 3 | 0 | 0 | 3 | PE |
| 20 | 22AI15020 | Advanced Java Programming | 3 | 0 | 0 | 3 | PE |
| 21 | 22AI15021 | Software Engineering | 3 | 0 | 0 | 3 | PE |
| **DATA ANALYTICS & DEPP LEARNING** | | | | | | | |
| 22 | 22AI15022 | Data Warehousing and Data Mining | 3 | 0 | 0 | 3 | PE |
| 23 | 22AI15023 | R Programming | 3 | 0 | 0 | 3 | PE |
| 24 | 22AI15024 | Knowledge Engineering | 3 | 0 | 0 | 3 | PE |
| 25 | 22AI15025 | Distributed Databases | 3 | 0 | 0 | 3 | PE |
| 26 | 22AI15026 | Data Visualization | 3 | 0 | 0 | 3 | PE |
| 27 | 22AI15027 | AI for Robotics | 3 | 0 | 0 | 3 | PE |
| 28 | 22AI15028 | Biometric Technologies | 3 | 0 | 0 | 3 | PE |
| 29 | 22AI15029 | Predictive Analysis | 3 | 0 | 0 | 3 | PE |
| 30 | 22AI15030 | Pattern Recognition | 3 | 0 | 0 | 3 | PE |
| 31 | 22AI15031 | Social Media Analysis | 3 | 0 | 0 | 3 | PE |
| 32 | 22AI15032 | Optimization Techniques | 3 | 0 | 0 | 3 | PE |
| 33 | 22AI15033 | Soft Computing | 3 | 0 | 0 | 3 | PE |
| **CYBER SECURITY** | | | | | | | |
| 34 | 22AI15034 | Introduction To Cyber Security | 3 | 0 | 0 | 3 | PE |
| 35 | 22AI15035 | Cryptography and Network Security | 3 | 0 | 0 | 3 | PE |
| 36 | 22AI15036 | Information Retrieval Techniques | 3 | 0 | 0 | 3 | PE |
| 37 | 22AI15037 | Cyber Forensics | 3 | 0 | 0 | 3 | PE |
| 38 | 22AI15038 | Fundamentals of Nano Science | 3 | 0 | 0 | 3 | PE |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 39 | 22AI15039 | Total Quality Management | 3 | 0 | 0 | 3 | PE |
| 40 | 22AI15040 | Swarm Intelligence | 3 | 0 | 0 | 3 | PE |

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence And Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** | |
| **22AI15001** | **INFORMATION STORAGE AND MANAGEMENT** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Gain the basic components of Storage System Environment.<br>• Familiarize the Storage Area Network Characteristics and Components.<br>• Examine emerging technologies including IP-SAN.<br>• Describe the different backup and recovery topologies and their role in providing disaster recovery and business continuity capabilities.<br>• Learn the local and remote replication technologies. | | | | | | |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Illustrate the logical and physical components of a Storage infrastructure.<br>• Evaluate storage architectures, including storage subsystems, DAS, SAN, NAS, and CAS.<br>• Explain the various forms and types of Storage Virtualization.<br>• Describe the different role in providing disaster recovery and business continuity capabilities.<br>• Distinguish different remote replication technologies. | | | | | | |
| **UNIT-I** | **STORAGE SYSTEMS** | | | | | | **9** |
| Introduction to Information Storage and Management: Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle. Storage System Environment: Components of the Host. RAID: Implementation of RAID, RAID Array Components, RAID Levels, RAID Comparison, RAID Impact on Disk Performance, Hot Spares. Intelligent Storage System: Components, Intelligent Storage Array. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models | | | | | | | |
| **UNIT-II** | **STORAGE NETWORKING TECHNOLOGIES** | | | | | | **9** |
| Direct-Attached Storage and Introduction to SCSI: Types of DAS, DAS Benefits and Limitations, Disk Drive Interfaces, Introduction to Parallel SCSI, SCSI Command Model. Storage Area Networks: Fiber Channel, SAN Evolution, SAN Components, Fiber Channel Connectivity, Fiber Channel Ports, Fiber Channel Architecture, Zoning, Fiber Channel Login Types, Fiber Channel Topologies. Network Attached Storage: Benefits of NAS, NAS File I/Components of NAS, NAS Implementations, NAS-Implementations, NAS File Sharing Protocols, NAS I/O Operations. | | | | | | | |

| UNIT-III | ADVANCED STORAGE NETWORKING AND VIRTUALIZATION | 9 |
|---|---|---|
| IP SAN: iSCSI, FCIP.Content-Addressed Storage: Fixed Content and Archives, Types of Archives, Features and Benefits of CAS, CAS Architecture, Object Storage and Retrieval in CAS, CAS Examples. Storage Virtualization: Forms of Virtualization, NIA Storage Virtualization Taxonomy, Storage Virtualization Configurations, Storage Virtualization Challenges, Types of Storage Virtualization. Data Center Environment-Building blocks of a data center- Software-defined data center | | |
| **UNIT-IV** | **BUSINESS CONTINUITY** | **9** |
| Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Lifecycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup and Recovery: Backup Purpose, Considerations, Backup architecture, Backup targets, Data deduplication.Granularity, Recovery Considerations, Backup Methods and Process, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments, Backup Technologies. | | |
| **UNIT-V** | **REPLICATION** | **9** |
| Local Replication: Source and Target, Uses of Local Replicas, Data Consistency, Local Replication Technologies, Restore and Restart Considerations, Creating Multiple Replicas, Management Interface. Remote Replication: Modes of Remote Replication and its Technologies, Network Infrastructure. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOK :** | |
|---|---|
| 1 | EMC Corporation-Second edition, Information Storage and Management, Wiley, India,2012 |
| **REFERENCES:** | |
| 1 | Robert Spalding, ―Storage Networks: The Complete Reference ―, Tata McGraw Hill, Osborne, 2003. |
| 2 | Marc Farley, ―Building Storage Networks, Tata McGraw Hill, Osborne, 2001. |
| 3 | Meeta Gupta, Storage Area Networks Fundamentals, Pearson Education Limited, 2002. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 1 | 1 | 1 | - | - | - | 2 | 1 | 3 | 2 | 2 | 1 | - |
| **CO2** | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | 1 | 2 | 2 | 3 | 1 | - |
| **CO3** | 3 | 3 | 2 | 2 | 3 | - | - | - | 1 | 1 | 2 | 2 | 3 | 2 | - |
| **CO4** | 2 | 3 | 3 | 2 | 3 | - | - | - | 2 | 1 | 2 | 3 | 2 | 2 | - |
| **CO5** | 2 | 3 | 3 | 2 | 2 | - | - | - | 3 | 1 | 2 | 3 | 3 | 3 | - |
| **Average** | **3** | 3 | **3** | **2** | **2** | **-** | **-** | **-** | **2** | **1** | **2** | **2** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**MAHENDRA ENGINEERING COLLEGE**
**(Autonomous)**

**Syllabus**

| **Department** | **Artificial Intelligence And Data Science** | **Programme Code** | **1031** |
|---|---|---|---|

**Program Elective**

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **2AI15002** | **COMPUTER NETWORKS** | 3 | 0 | 0 | 3 | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Gain Knowledge about the protocol layering and physical level communication.<br>• Analyze the performance of a network.<br>• Familiar with the various components required to build different networks.<br>• Learn the functions of network layer and the various routing protocols.<br>• Familiarize the functions and protocols of the Transport layer. |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Explain the basic layers and its functions in computer networks.<br>• Evaluate the performance of a network.<br>• Understand the basics of how data flows from one node to another.<br>• Analyze and design routing algorithms.<br>• Design protocols for various functions in the network. |

| **UNIT-I** | **INTRODUCTION & PHYSICAL LAYER** | 9 |
|---|---|---|

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

| **UNIT-II** | **DATA-LINK LAYER & MEDIA ACCESS CONTROL** | 9 |
|---|---|---|

Introduction – Link-Layer Addressing – DLC Services –Goback N - Sliding Windows- Selective Repeat-Stop& Wait-Data-Link Layer Protocols – HDLC– PPP - Media Access Control - Wired LANs: Ethernet - Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices.

| **UNIT-III** | **NETWORK LAYER** | 9 |
|---|---|---|

Network Layer Services - Packet Switching - IPV4 Addresses - Forwarding of IP Packets - Network Layer - Protocols: IP, ICMPv4, Mobile IP - Routing Algorithms- Unicast Routing Protocols- Multicast Routing Protocols - Next Generation IP: IPv6 Addressing, IPv6 Protocol.

| **UNIT-IV** | **TRANSPORT LAYER** | 9 |
|---|---|---|

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol - Congestion Control – SCTP.

| **UNIT-V** | **APPLICATION LAYER** | 9 |
|---|---|---|

WWW and HTTP – Electronic Mail - Telnet - SSH - DNS - SNMP – DHCP – IMAP – TLS/SSL – IP Security

| | |
|---|---|
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1. | Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013. |
| 2. | Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012. |
| **REFERENCES:** | |
| 1 | James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Seventh Edition, Pearson Education, 2017. |
| 2 | William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013. |
| 3 | Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014. |
| 4 | Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open Source Approach, McGraw Hill Publisher, 2011. |
| 5 | James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 3 | - | - | - | - | 1 | 1 | 3 | 1 | 3 | 2 | - |
| **CO2** | 3 | 2 | 1 | 2 | 2 | - | - | - | 2 | 2 | 2 | 1 | 3 | 2 | - |
| **CO3** | 2 | 2 | 3 | 2 | 1 | - | - | - | 3 | 3 | 1 | 2 | 1 | 1 | - |
| **CO4** | 1 | 3 | 1 | 3 | 1 | - | - | - | 1 | 2 | 1 | 1 | 1 | 3 | - |
| **CO5** | 3 | 3 | 1 | 1 | 2 | - | - | - | 2 | 2 | 2 | 2 | 2 | 2 | - |
| **Average** | **2** | 2 | **2** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **2** | **1** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence and Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15003** | **SOCIAL NETWORK ANALYSIS** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Gain the concept of semantic web and related applications.<br>• Learn knowledge representation using ontology.<br>• Familiar with the human behavior in social web and related communities.<br>• Provide knowledge of predicting human behavior for social communities<br>• Learn visualization of social networks. | | | | | |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Develop semantic web related applications.<br>• Represent knowledge using ontology.<br>• Predict human behavior in social web and related communities.<br>• Describe the knowledge of predicting human behavior for social communities<br>• Visualize social networks. | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | **9** |
| Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web Social Network Analysis: Social Networks Perspective - Analysis of Network Data - Interpertation of Network Data - Social Network Analysis in the Social and Behavioral Sciences - Metrics in social network analysis | | | | | | |
| **UNIT-II** | **SOCIAL NETWORK ANALYSIS SOFTWARE, TOOLS AND LIBRARIES** | | | | | **9** |
| Modelling and aggregating social network data: Ontological representation of social individuals – Ontological representation of social relationships - Aggregating and reasoning with social network data – Advanced representations. Social network analysis software - Tools - Libraries . | | | | | | |
| **UNIT-III** | **CLIQUES, CLUSTERS AND COMPONENTS** | | | | | **9** |
| Components and Subgraphs: Sub graphs - Ego Networks, Triads, Cliques, Hierarchical Clustering,Triads, Network Density and conflict. Density: Egocentric and Sociocentric - Digression on Absolute Density – Community structure and Density, Centrality : Local and Global - Centralization and Graph Centres, Cliques and their intersections, Components and Citation Circles - Positions, Sets and Clusters. | | | | | | |
| **UNIT-IV** | **PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES** | | | | | **9** |
| Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context -Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective | | | | | | |

| | | |
|---|---|---|
| logic - Trust network analysis | | |
| **UNIT-V** | **GRAPH DATA IN THE REAL WORLD AND APPLICATION OF SOCIAL NETWORKS** | **9** |
| Medium data - Tradition, Big Data, Small Data - Flat File Representations, Medium Data – Data Representation, Working with 2-Mode Data, Social Networks and Big Data, Big Data at work. Visualizing online social networks, Advances in Network | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | PeterMika,-Social Network sand the Semantic Web|,FirstEdition,Springer2007. |
| 2 | Borko Furht,-Handbook of Social Network Technologies andApplications,1st Edition ,Springer, 2010. |
| **REFERENCES:** | |
| 1 | GuandongXu,Yanchun Zhangand LinLi, -Web Mining and Social Networking– Techniques and applications, First Edition, Springer,2011. |
| 2 | Dion Gohand SchubertFoo,- Socialinformation Retrieval Systems: Emerging Technologiesand Applications for Searching the Web Effectively,IGI Global Snippet,2008. |
| 3 | MaxChevalier, Christine Julienand Chantal Soulé-Dupuy,-Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling,IGI Global Snippet,2009. |
| 4 | John G. Breslin, Alexander Passant and Stefan Decker, -The Social Semantic Web, Springer, 2009. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | 3 | - | - | - | - | 1 | 1 | 3 | 1 | 3 | 1 | - |
| **CO2** | 3 | 2 | 2 | 3 | 2 | - | - | - | 2 | 2 | 2 | 1 | 3 | 2 | - |
| **CO3** | 3 | 3 | 3 | 3 | 1 | 2 | - | - | 3 | 2 | 2 | 2 | 1 | 1 | - |
| **CO4** | 2 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 1 | 2 | 1 | 3 | - |
| **CO5** | 3 | 3 | 1 | 1 | 2 | - | - | - | 2 | 2 | 2 | 2 | 2 | 2 | - |
| **Average** | **3** | 3 | **2** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **2** | **1** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence and Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum Marks** | |
| **22AI15004** | **INFORMATION SECURITY** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn the basics of Information Security<br>• Know the legal, ethical and professional issues in information security.<br>• Gain information about the aspects of risk management<br>• Design the security architecture, policies, standards and practices<br>• Acquire knowledge about the Security technology and Intrusion Detection System. | | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to**<br>• Discuss the basics of information security<br>• Illustrate the legal, ethical and professional issues in information security<br>• Demonstrate the aspects of risk management.<br>• Become aware of various standards in the Information Security System<br>• Design and implementation of Security Techniques. | | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | | **9** |
| History - What is Information Security? - Critical Characteristics of Information - NSTISSC Security Model - Components of an Information System - Securing the Components - Balancing Security and Access - The SDLC - The Security SDLC. | | | | | | | |
| **UNIT-II** | **SECURITY INVESTIGATION** | | | | | | **9** |
| Need for Security - Business Needs - Threats – Attacks - Legal - Ethical and Professional Issues. An overview of computer security-Access control matrix, Policy-Security policies-Confidentiality policies, Integrity Policies and Hybrid policies. | | | | | | | |
| **UNIT-III** | **SECURITY ANALYSIS** | | | | | | **9** |
| Introduction - An Overview of Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy - Risk Management Discussion Points – Documenting Results - Recommended Practices in Controlling Risk. | | | | | | | |
| **UNIT-IV** | **LOGICAL DESIGN** | | | | | | **9** |
| Introduction - Information Security Policy, Standards and Practices -The Information Security Blueprint: ISO 17799/BS 7799, ISO 27001and its controls - NIST Security Models - Design of Security Architecture - Continuity Strategies. | | | | | | | |
| **UNIT-V** | **PHYSICAL DESIGN** | | | | | | **9** |
| Security Technology – IDS - Scanning and Analysis Tools – Cryptography-Access Control Devices - Physical Security - Security and Personnel. | | | | | | | |

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|---|---|
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOK:** | |
| 1 | Michael E Whitman and Herbert J Mattord, ―Principles of Information Security, Vikas Publishing House, New Delhi, 2003 (Unit I – V) |
| **REFERENCES:** | |
| 1 | Micki Krause, Harold F. Tipton, ― Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004. |
| 2 | Stuart Mc Clure, Joel Scrambray, George Kurtz, ―Hacking Exposed, Tata McGraw-Hill, 2003 |
| 3 | Matt Bishop, ― Computer Security Art and Science, Pearson/PHI, 2002. |
| **E-REFERENCES:** | |
| 1. | http://www.consciouskidsacademy.org/Principles%20of%20Information%20Security%204th%20edition%20-%20Michael%20E%20Whitman.pdf |
| 2. | https://lecturenotes.in/subject/453/information-security-is |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | - | - | - | - | 1 | 3 | 1 | 2 | 3 | 1 | - |
| **CO2** | 1 | 3 | 3 | 3 | 2 | - | - | - | 1 | 2 | 2 | 2 | 2 | 1 | - |
| **CO3** | 2 | 3 | 3 | 3 | 1 | - | - | - | 1 | 3 | 1 | 2 | 1 | 2 | - |
| **CO4** | 2 | 3 | 2 | 2 | 1 | - | - | - | 2 | 2 | 1 | 2 | 1 | 3 | - |
| **CO5** | 3 | 3 | 1 | 1 | 2 | - | - | - | 2 | 2 | 2 | 2 | 2 | 2 | - |
| **Average** | **3** | 3 | **2** | **2** | **2** | **-** | **-** | **-** | **2** | **2** | **2** | **1** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence and Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** | |
| **22AI15005** | **SOFTWARE DEFINED NETWORKS** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn the fundamentals of software defined networks.<br>• Gain the separation of the data plane and the control plane.<br>• Aware of data centers in software defined networks<br>• Learn about the SDN Programming.<br>• Observe the various applications of SDN | | | | | | |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Analyze the evolution of software defined networks.<br>• Express the various components of SDN and their uses.<br>• Explain the use of SDN in the current networking scenario.<br>• Develop the SDN programming using current language and tools<br>• Design and develop various applications of SDN. | | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | | **9** |
| History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes | | | | | | | |
| **UNIT-II** | **OPEN FLOW & SDN CONTROLLERS** | | | | | | **9** |
| Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor- Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts. | | | | | | | |
| **UNIT-III** | **DATA CENTERS** | | | | | | **9** |
| Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE | | | | | | | |
| **UNIT-IV** | **SDN PROGRAMMING** | | | | | | **9** |
| Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications | | | | | | | |
| **UNIT-V** | **SDN** | | | | | | **9** |
| Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration | | | | | | | |
| | | | | | | **TOTAL HOURS** | **45** |

| TEXT BOOKS: | |
|---|---|
| 1 | Thomas D. Nadeau, Ken Gray, “SDN: Software Defined Networks”, O'Reilly Media, August 2013. |
| 2 | Paul Goransson and Chuck Black, “Software Defined Networks: A Comprehensive Approach”, First Edition, Morgan Kaufmann, June 2014. |
| **REFERENCES:** | |
| 1 | Siamak Azodolmolky, “Software Defined Networking with Open Flow”, Packet Publishing, 2013. |
| 2 | Vivek Tiwari, “SDN and Open Flow for Beginners”, Amazon Digital Services, Inc., 2013. |
| 3 | Fei Hu, Editor, “Network Innovation through Open Flow and SDN: Principles and Design”, CRC Press, 2014 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 2 | 3 | 1 | 3 | - | - | - | 2 | 3 | 1 | 3 | 1 | 2 | - |
| **CO2** | 2 | 1 | 2 | 2 | 3 | - | - | - | 2 | 2 | 2 | 2 | 1 | 3 | - |
| **CO3** | 2 | 2 | 2 | 3 | 3 | - | - | - | 3 | 1 | 1 | 2 | 1 | 3 | - |
| **CO4** | 2 | 2 | 2 | 3 | 1 | - | - | - | 1 | 3 | 1 | 2 | 2 | 2 | - |
| **CO5** | 3 | 3 | 1 | 1 | 3 | - | - | - | 1 | 2 | 1 | 2 | 2 | 1 | - |
| **Average** | **2** | 2 | **2** | **2** | **2.6** | **-** | **-** | **-** | **1.8** | **2.2** | **1.2** | **2.2** | **1.4** | **2.2** | **-** |

**1 - Low, 2 - Medium, 3 - High, ‘-“- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence and Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum Marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15006** | **NETWORK MANAGEMENT** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Explore difference between SNMPV1, V2, V3 & ASN<br>• Study about remote monitoring and its application.<br>• Discuss the basic terminologies and application 22 of telecommunication management system.<br>• Expose the application of network management<br>• Examine the importance of broadband Networks | | | | | |
| **Outcome(s)** | . **Upon completion of this course, students will be able to:**<br>• IllustratethestandardsandmodelsofSNMPV1.,V2,V3&ASN<br>• Analyze the challenges faced by remote monitoring and suggest suitable solutions.<br>• Recommend telecommunication management network standards for real time scenarios.<br>• Evaluate the various applications of network management system.<br>• Compare and contrast the different broadband network strategies. | | | | | |
| **UNIT-I** | **BASIC TERMINOLOGIES** | | | | | **9** |
| Network Management Goals, organization and Functions, Network Management Architecture and Organization, Network Management Perspective, NMS platform, Future ofNetworkManagement-ASN.1-Terminology, Symbols and Conventions, Objects and Data Types. | | | | | | |
| **UNIT-II** | **SIMPLE NETWROK MANAGEMENT PROTOCOL** | | | | | **9** |
| SNMP- operations, SNMP V1 Network Management, Basic Foundation Standards, Models and languages, Organization and information Models, Communication and functional Models. SNMP V2 - Changes , System Architecture, Structure of Management Information, MIB, Protocol, Compatibility. SNMP V3 – Key Features, Architecture, Application, MIB, Security. | | | | | | |
| **UNIT-III** | **REMOTE MONITORING&TELECOMMUNICATION MANAGEMENT** | | | | | **9** |
| RMON SBI MIB, RMON1, RMON2, ATM ROM- TMN conceptual Model, Standards,RMON1 Groups and Functions, Relationship between control and tables-Token Ring Extension Groups, RMON2-Management Information Base, Conformation specification-Architecture, Implementation- | | | | | | |
| **UNIT-IV** | **NETWORK MANAGEMENT APPLICATION** | | | | | **9** |

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|---|---|---|
| NetworkManagementApplication–ConfigurationManagement,FaultManagement,Performance Management, Event Correlation techniques, Security Management, Cryptography, Authentication and Authorization, Policy- based Management, Service level Management. | | |
| **UNIT-V** | **BROADBAND NETWORKS MANAGEMENT** | **9** |
| ATM Technology, ATM Network Management, Wireless Access Network, Basic Principles, Mobile Wireless Networks,Satellite Networks, Broadband Home Networks, ADSL Performance Management, SNMP-Based ADSL line MIB,ADSL configuration lines. | | |
| | **TOTAL HOURS** | **45** |

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|---|---|
| **TEXTBOOKS:** | |
| 1 | Mani Subramanian "Network Management : Principles and Practice Pearson Edition"2nd Edition, ISBN:978-8131734049,2010. |
| 2. | Adrian Farrel,"Network Management–Knowitall",Morgan Kaufmann Publishers,1st Edition ISBN: 9780080923420, 2008. |
| **REFERENCES:** | |
| 1 | Deborah E.Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012. |
| 2 | Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", McGraw Hill Education, 2011. |
| 3 | Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd, 2013. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 1 | - | - | - | - | - | - | 1 | 3 | 3 | 1 | 2 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | - | 1 | 2 | 3 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | - | 2 | 3 | 3 | 2 | 1 | - |
| **CO5** | 3 | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 3 | 2 | 2 | - |
| **Average** | **3** | **2** | **1.4** | **-** | **-** | **-** | **-** | **-** | **-** | **1.2** | **2.6** | **3** | **2** | **1.8** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**MAHENDRAENGINEERING COLLEGE**
**(Autonomous)**

**Syllabus**

| **Department** | **Artificial Intelligence And Data Science** | **Programme Code** | **1161** |
|---|---|---|---|

**Program Elective**

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22AI15007** | **Artificial Neural Networks** | 3 | 0 | 0 | 3 | **100** |

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| **Objective(s)** | **The student should be made to:**<br>• Impart knowledge about the basic principles, techniques, and applications of neural network.<br>• Provide the mathematical background for carrying out the optimization associated with neural network learning.<br>• Develop the skills to gain basic understanding of the areas of Artificial Neural Networks and Fuzzy Logic.<br>• Gain the biological neural network and to model equivalent neuron models.<br>• Learn the architecture, learning algorithm and issues of various feed forward and feedback neural networks |
| **Outcome(s)** | **Upon completion of th is course, students will be able to:**<br>• Develop applications of neural network.<br>• Create different neural networks of various architectures both feed forward and feed backward.<br>• Perform the training of neural networks using various learning rules.<br>• Perform the testing of neural networks and do the perform analysis of these networks for various pattern recognition applications.<br>• Develop application on different soft computing techniques like Fuzzy, GA and Neural network |

| **UNIT-I** | **INTRODUCTION** | 9 |
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**Introduction**: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

**Learning Process**: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

| **UNIT-II** | **Single Layer Perceptrons and Multilayer Perceptrons** | 9 |
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|---|---|---|
| **Single Layer Perceptrons**: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment ,Multilayer Perceptron. | | |
| **UNIT-III** | **Back Propagation** | 9 |
| **Back Propagation:** Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning | | |
| **UNIT-IV** | **Self-Organization Maps (SOM)** | 9 |
| **Self-Organization Maps (SOM):** Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification. | | |
| **UNIT-V** | **Neuro Dynamics** | 9 |
| **Feedback neural networks:-** Pattern storage and retrieval, Hopfield model, Boltzmann machine, Recurrent neural networks. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Neural Network Design, Second Edition, Martin T. Hagan, Howard B. Demuth, Mark Hudson Beale, and Orlando De Jesús, 2014. |
| 2 | Computational Intelligence: An Introduction, Second Edition, Andries P. Engelbrecht, 2007, Wiley. . |
| **REFERENCES:** | |
| 1 | Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd 2005 |
| 2 | Neural Networks in Computer Inteligance, Li Min Fu MC GRAW HILL EDUCATION 2003 |
| 3 | Neural Networks -James A Freeman David M S Kapura Pearson Education 2004. |
| 4 | Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | 1 | 1 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | 3 | 3 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | 2 | - | 3 | 3 | 2 | 3 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | 2 | - | 3 | 3 | 2 | 2 | - |
| **Average** | **3** | 2 | **2** | **-** | **-** | **-** | **-** | **-** | **2** | **-** | **3** | **3** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence and Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours /week** | | | **Credit** | **Maximum marks** |
| **22AI15008** | **INTRODUCTION TO IOT** | **L** | **T** | **P** | **C** | **100** |
| | | 3 | 0 | 0 | 3 | |
| **Objective(s)** | **The student should be made to:**<br>• Familiarize Smart Objects and IoT Architectures.<br>• Learn about various IoT-related protocols.<br>• Build simple IoT Systems using Arduino and Raspberry Pi.<br>• Gain the Knowledge about the data analytics and cloud in the context of IoT.<br>• Be exposed with IoT infrastructure for popular applications | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to:**<br>• Explain the concept of IoT.<br>• Examine various protocols for IoT.<br>• Apply the IoT System using Raspberry Pi/Arduino.<br>• Apply the data analytics and use cloud offerings related to IoT.<br>• Summarize applications of IoT in real time scenario. | | | | | |
| **UNIT-I** | **INTRODUCTION TO INTERNET OF THINGS** | | | | | **9** |
| Definition & Characteristics of IoT - Challenges and Issues - Physical Design of IoT, Logical Design of IoT - IoT Functional Blocks, Security. | | | | | | |
| **UNIT-II** | **IOT PROTOCOLS** | | | | | **9** |
| 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. | | | | | | |
| **UNIT-III** | **DESIGN AND DEVELOPMENT** | | | | | **9** |
| 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. | | | | | | |
| **UNIT-IV** | **DATA ANALYTICS AND SUPPORTING SERVICES** | | | | | **9** |
| Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – | | | | | | |

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|---|---|---|
| AWS for IoT – System Management with NETCONF-YANG. | | |
| **UNIT-V** | **CASE STUDIES/INDUSTRIAL APPLICATIONS** | **9** |
| Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS :** | |
| 1 | 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. |
| **REFERENCES:** | |
| 1 | Arshdeep Bahga, Vijay Madisetti, -Internet of Things – A hands-on approach, Universities Press, 2015. |
| 2 | Olivier Hersent, David Boswarthick, Omar Elloumi , -The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2). |
| 3 | Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014. |
| 4 | Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 1 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO4** | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 3 | 1 | - |
| **CO5** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 1 | - |
| **Average** | **3** | **2** | **1.4** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **3** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence and Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15009** | **CLOUD COMPUTING** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Familiarize with the fundamentals of cloud computing<br>• Gain expertise in server, network and storage virtualization.<br>• Learn fundamental concepts in cloud architecture, storage and services<br>• Understand the cloud resource management and security issues<br>• Expose to advanced topics I cloud computing and applications | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to**<br>• Explain the main concepts, key technologies, strengths and limitations of cloud computing.<br>• Describe various technologies in server, network and storage virtualization<br>• Interpret the architecture of compute and storage cloud, service and delivery models<br>• Identify the main security and privacy issues in cloud computing<br>• Choose appropriate technologies for implementation and application of cloud | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | **9** |
| Introduction to Cloud Computing-Definition of Cloud – Evolution of Cloud Computing – Underlying principles of parallel and distributed computing – Cloud characteristics – Multi tenancy challenges in storage-Cloud cube model – Elasticity in Cloud – On-demand Provisioning-Cloud computing scalability | | | | | | |
| **UNIT-II** | **VIRTUALIZATION INFRASTRUCTURE** | | | | | **9** |
| Virtual Machine Basics–Taxonomy of Virtual machines– Process and System Virtual Machines – Server Virtualization –Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization - Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation. | | | | | | |
| **UNIT-III** | **CLOUD ARCHITECTURE, SERVICES AND STORAGE** | | | | | **9** |
| Layered Cloud Architecture Design – NIST Cloud computing Reference architecture – Public, private and hybrid clouds – IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3. | | | | | | |
| **UNIT-IV** | **RESOURCE MANAGEMENT AND SECURITY IN CLOUD** | | | | | **9** |
| Inter Cloud Resource Management- Resource bundling: Combinatorial auctions for cloud resources – Resource Provisioning and Resource Provisioning methods – Global Exchange of Cloud resources – | | | | | | |

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|---|---|---|
| Networking support - Cloud Security Overview and Challenges – Software-as-a-service Security – Security governance – Virtual Machine security – IAM – Security Standards | | |
| **UNIT-V** | **CLOUD TECHNOLOGIES AND APPLICATIONS** | **9** |
| Hadoop – Map Reduce – Virtual Box – Programming support :Google App Engine -Amazon AWS – Federation in the Cloud and Four levels of Federation– Federated services and applications – Future of federation- Case Study – Cloud Computing for Software Parks– an Enterprise with Multiple Data Centers | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Kai Hwang, Geoffrey C.Fox, Jack G.Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012. |
| 2 | Rajkumar Buyya, Christian Vecchiola, S.Thamarai Sel "Mastering Cloud Computing: Foundations and Applications Programming", Morgan Kaufmann Publications, 2016. |
| **REFERENCES:** | |
| 1 | Rittinghouse, John W., and James F.Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017. |
| 2 | Anthony Velte, Robert Elsenpeter, Toby Velte, "Cloud Computing, A Practical Approach", Tata Mc Graw Hill, 2009. |
| 3 | George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for Ec2 and Beyond", O'Reilly, 2009. |
| 4 | Nptel course, Cloud Computing, https://onlinecourses.nptel.ac.in/noc18_cs16/preview |
| 5 | Dan C. Marinescu "Cloud Computing Theory and Practice", Morgan Kaufmann Publications, 2013. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 1 | 2 | - |
| **CO4** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 2 | 2 | 1 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **Average** | **3** | **2** | **1.2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2.8** | **2.8** | **1.6** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Computer Science and Engineering** | | **Programme Code** | | | **1161** | |
| **B.Tech – Artificial Intelligence & Data Science** | | | | | | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | | **C** | |
| **22AI15010** | **MULTI CORE COMPUTING** | 3 | 0 | 0 | | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Define technologies of multicore computing and performance measures<br>• Demonstrate problems related to multiprocessing<br>• Illustrate Concurrency and Correctness programming<br>• Analyze the common problems in multicore programming<br>• Gain the knowledge in shared memory | | | | | | |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Identify the limitations Lower Bounds on the Number of Locations<br>• Define fundamental concepts of parallel programming and its design issues<br>• Solve the issues related to multiprocessing and Hierarchical Locks<br>• Apply the salient features of different multicore architectures and how they exploit parallelism<br>• Demonstrate the concepts of Optimistic Synchronization. | | | | | | |
| **UNIT-I** | **INTRODUCTION TO MULTI CORE COMPUTING** | | | | | | **9** |
| Shared Objects and Synchronization - A Fable - Mutual Exclusion – Time - Critical Sections – 2 Thread Solutions - Lamport's Bakery Algorithm - Bounded Timestamps - Lower Bounds on the Number of Locations - Concurrent Objects - Concurrency and Correctness - Quiescent Consistency – Linearizability - The Java Memory Model. | | | | | | | |
| **UNIT-II** | **FOUNDATIONS OF SHARED MEMORY** | | | | | | **9** |
| The Space of Registers - Register Constructions - Atomic Snapshots - The Relative Power of Primitive Synchronization Operations: Consensus Numbers - Consensus Protocols - FIFO Queues - Multiple Assignment Objects - Common2 RMW Operations - The compare AndSet() Operation | | | | | | | |
| **UNIT-III** | **UNIVERSALITY OF CONSENSUS** | | | | | | **9** |
| A Lock-Free Universal Construction - A Wait-Free Universal Construction - Spin Locks and Contention: Test-And-Set Locks - TAS-Based Spin Locks Revisited - Exponential Backoff - Queue Locks - A Queue Lock with Timeouts - Hierarchical Locks. | | | | | | | |
| **UNIT-IV** | **MONITORS AND BLOCKING SYNCHRONIZATION** | | | | | | **9** |
| Monitor Locks and Conditions - Readers–Writers Locks - Our Own Reentrant Lock – Semaphores - Linked Lists: The Role of Locking : List-Based Sets - Concurrent Reasoning - Coarse-Grained Synchronization - Fine-Grained Synchronization - Optimistic Synchronization - Lazy Synchronization - Non-Blocking Synchronization. | | | | | | | |
| **UNIT-V** | **COUNTING, SORTING, AND DISTRIBUTED COORDINATION** | | | | | | **9** |
| Shared Counting - Software Combining - Quiescently Consistent Pools and Counters - Counting Networks - Diffracting Trees - Parallel Sorting - Sorting Network - Distributed Coordination. | | | | | | | |
| | | | | | | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | The Art of Multiprocessor Programming Revised - First Edition Maurice Herlihy, Nir Shavit. |
| 2 | Multicore Computing algorithms, Architectures, And Applications Edited By Sanguthevar Rajasekaran, Lance Fiondella, Mohamed Ahmed, Reda A. Ammar copyright 2014 |
| **REFERENCES:** | |
| 1 | Programming Multi-Core And Many-Core Computing Systems Sabri Pllana, Fatos Xhafa 2017. |
| 2 | Multicore and GPU Programming An Integrated Approach 2nd Edition -2022,Gerassimos Barlas. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 2 | 3 | 1 | 3 | - | - | - | 2 | 3 | 1 | 3 | 1 | 2 | - |
| **CO2** | 2 | 1 | 2 | 2 | 3 | - | - | - | 2 | 2 | 2 | 2 | 1 | 3 | - |
| **CO3** | 2 | 2 | 2 | 3 | 3 | - | - | - | 3 | 1 | 1 | 2 | 1 | 3 | - |
| **CO4** | 2 | 2 | 2 | 3 | 1 | - | - | - | 1 | 3 | 1 | 2 | 2 | 2 | - |
| **CO5** | 3 | 3 | 1 | 1 | 3 | - | - | - | 1 | 2 | 1 | 2 | 2 | 1 | - |
| **Average** | **2** | 2 | **2** | **2** | **2.6** | **-** | **-** | **-** | **1.8** | **2.2** | **1.2** | **2.2** | **1.4** | **2.2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum Marks** | |
| **22AI15011** | **DISTRIBUTED COMPUTING** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Provide students with contemporary knowledge in distributed systems<br>• Equip students with skills to analyze and design distributed applications.<br>• Provide master skills to measure the performance of distributed synchronization algorithms<br>• Familiarize hardware and software issues in modern distributed systems.<br>• Gain the knowledge in Fault Tolerance Reliable client-server & recovery | | | | | | |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Demonstrate knowledge of the basic elements and concepts related to distributed system technologies;<br>• Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.<br>• Analyze the various techniques used for clock synchronization and mutual exclusion<br>• Demonstrate the concepts of Resource and Process management and synchronization algorithms<br>• Demonstrate the concepts of Consistency and Replication Management | | | | | | |
| **UNIT-I** | **INTRODUCTION TO DISTRIBUTED SYSTEMS** | | | | | | **9** |
| Characterization of Distributed Systems: Issues Goals and Types of distributed systems - Distributed System Models - Hardware concepts - Software Concept - Middleware: Models of Middleware - Services offered by middleware - Client Server model. | | | | | | | |
| **UNIT-II** | **COMMUNICATION** | | | | | | **9** |
| Layered Protocols – Inter process communication (IPC): MPI - Remote Procedure Call (RPC) - Remote Object Invocation - Remote Method Invocation (RMI) - Message Oriented Communication, Stream Oriented Communication - Group Communication | | | | | | | |
| **UNIT-III** | **SYNCHRONIZATION** | | | | | | **9** |
| Clock Synchronization - Logical Clocks - Election Algorithms - Mutual Exclusion - Distributed Mutual Exclusion - Classification of mutual Exclusion Algorithm - Requirements of Mutual Exclusion Algorithms - Performance measure. | | | | | | | |
| **UNIT-IV** | **RESOURCE AND PROCESS MANAGEMENT** | | | | | | **9** |

| | | |
|---|---|---|
| Desirable Features of global Scheduling algorithm - Task assignment approach - Load balancing approach - load sharing approach -Introduction to process management - process migration – Threads – Virtualization – Clients – Servers - Code Migration | | |
| **UNIT-V** | **CONSISTENCY, REPLICATION AND FAULT TOLERANCE** | **9** |
| Introduction to replication and consistency – Data Centric and Client Centric Consistency Models - Replica Management - Fault Tolerance: Introduction - Process resilience - Reliable client-server and group communication - Recovery | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS** | |
| 1 | Andrew S. Tanenbaum and Maarten Van Steen, ―Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education |
| 2 | George Coulouris, Jean Dollimore, Tim Kindberg, , "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005. |
| **REFERENCES** | |
| 1 | A. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006. |
| 2 | M. L. Liu, ―Distributed Computing Principles and Applications‖, Pearson Addison Wesley, 2004. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 1 | 2 | - |
| **CO4** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 2 | 2 | 1 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **Average** | **3** | **2** | **1.2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2.8** | **2.8** | **1.6** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, ‘-“- No Correlation**

| MAHENDRAENGINEERINGCOLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Coursecode** | **CourseName** | **Hours/week** | | | **Credit** | **Maximum marks** |
| **22AI15012** | **VIRTUALIZATIN TECHNIQUES** | **L** 3 | **T** 0 | **P** 0 | **C** 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Familiarize the concept of Virtualization concepts<br>• Gain the Virtualized Operating system.<br>• Learn the concept of virtualization storage<br>• Gain the Knowledge about the technologies of network virtualization<br>• Learn virtual machine products | | | | | |
| **Outcome(s)** | **Upon completion of the course, the students should be able to:**<br>• Identify the need of virtualization infrastructure.<br>• Create OS level virtualization.<br>• Identify storage level virtualization.<br>• Analyze network level virtualization.<br>• To compare and analyze various virtual machines products | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | **9** |
| Architect for virtualization-virtualization–five step process–Discovery–Hardware maximization–Architectures–Manage virtualization-Build there source pool–planning and preparation–network layer–storage–host servers–testing-levels. | | | | | | |
| **UNIT-II** | **OSVIRTUALIZATION** | | | | | **9** |
| Hardware level virtualization–OS level Virtualization–Interception Technique on windows–Featherweight Virtual Machine-FVMstates-operations–Design of virtualization layer Implementation–System call analysis–Limitations of FVM. | | | | | | |
| **UNIT-III** | **STORAGEVIRTUALIZATION** | | | | | **9** |
| Storage virtualization–Enhanced Storage and Data Services–Implementation–High Availability –Performance–Capacity–SNIA storage management–Policy based service level management– Future of storage virtualization. | | | | | | |
| **UNIT-IV** | **NETWORKVIRTUALIZATION** | | | | | **9** |
| Key Concepts-Architecture–Virtualized network Components-Logical Networks-Logical Network Design-Naming Conventions-Port profiles-uplink port profiles network adapter port pro files– Logical switches-planning logical switch design-deployment–Operations. | | | | | | |
| **UNIT-V** | **VIRTUAL MACHINESPRODUCTS** | | | | | **9** |

| | |
|---|---|
| XenVirtual machine monitors-Xen API–VMware–VM ware products-Vm ware Features–<br>Microsoft Virtual Server–Features of Microsoft Virtual Server. | |
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXTBOOKS:** | |
| 1 | Matthewportnoy,"VirtualizationEssentials",SYBEX(WileyBrand)2ndEdition,2016. |
| 2 | YangYu,"OS-levelVirtualizationandItsApplications",ProQuestLLC,2009. |
| 3 | FrankBunn,NikSimpson,RobertPeglar,GeneNagle,"TechnicalTutorial–Storage Virtualization",StorageNetworkingAssociation(SNIA),2004. |
| **REFERENCES:** | |
| 1 | DanielleRuest,NelsonRuest,"Virtualization: ABeginner'sGuide",McGraw-Hill,2009. |
| 2 | Nigel Cain,Alvin Morales, Michel Luescher,Damian Flynn Mitch Tulloch,"Microsoft System Center-Building a virtualized Network Solution",Microsoft press,2004. |
| 3 | MatthewPortney,"Virtualization Essentials",JohnWiley&Sons,2012. |
| 4 | Timcerfing,Jeffbuller,Chuck Enstall, Richard Ruiz,"Mastering Microsoft Virtualization",Wiley Publication,2010. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 3 | 1 | 3 | 2 | - | - | - | 1 | 1 | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | 1 | 2 | - | - | - | 1 | 2 | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 2 | 1 | 3 | 1 | - | - | - | 2 | 2 | 2 | 3 | 1 | 2 | - |
| **CO4** | 1 | 1 | 2 | 3 | 3 | - | - | - | 3 | 3 | 3 | 2 | 2 | 1 | - |
| **CO5** | 1 | 3 | 2 | 3 | 1 | - | - | - | 2 | 1 | 3 | 3 | 1 | 1 | - |
| **Average** | **2** | **2** | **2** | **3** | **2** | **-** | **-** | **-** | **2** | **2** | **2.8** | **2.8** | **1.6** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRAENGINEERINGCOLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **ProgrammeCode** | | | | **1161** |
| **Program Elective** | | | | | | |
| **Coursecode** | **CourseName** | **Hours/week** | | | **Credit** | **Maximum marks** |
| **22AI15013** | **GAME PROGRAMMING** | **L** | **T** | **P** | **C** | **100** |
| | | **3** | **0** | **0** | **3** | |
| **Objective(s)** | **The student should be made to:**<br>• Familiarize with the process of game design and development<br>• Learn the processes, mechanics , issuesing a me design<br>• Learn the architecture of game programming<br>• Know about game engine development, modeling,techniques and frameworks<br>• Use interactive games tools like OpenGL,DirectX. | | | | | |
| **Outcome(s)** | **Upon completion of the course,the students should be able to:**<br>• Discuss the concepts of Game design and development.<br>• Design the processes, and use mechanics for game development.<br>• Explain the Core architectures of Game Programming.<br>• Describe Game programming platforms, frame works and engines.<br>• Createinter active Games. | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | **9** |
| Elements of Game Play – Artificial Intelligence – Getting Input from the Player - Sprite Programming–Sprite Animation- Multithreading–Importance of Game Design–Game Loop. | | | | | | |
| **UNIT-II** | **3D GRAPHICS FOR GAME PROGRAMMING** | | | | | **9** |
| Coordinate Systems,Ray Tracing,Modelingin Game Production,Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces. | | | | | | |
| **UNIT-III** | **GAME DESIGN PRINCIPLES** | | | | | **9** |
| Character Development, Story Telling, Narration,Game Balancing, Core mechanics, Principlesof leveldesign,GenresofGames,CollisionDetection,GameLogic,GameAI,Path Finding. | | | | | | |
| **UNIT-IV** | **GAMING ENGINE DESIGN** | | | | | **9** |
| Renderers, Software Rendering, Hardware Rendering, and Controller Based Animation, Spatial Sorting,Level of Detail, physics,Collision Detection,Euler integration,Audio system importance, typesofaudioingame. | | | | | | |

| UNIT-V | GAME DEVELOPMENT | 9 |
|---|---|---|
| Texture Mapping, Camera Lights, Developing 2D and 3D Interactive Games Using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle Games, Single Player Games,Multi- PlayerGames. | | |
| | **TOTAL HOURS** | **45** |

| **TEXTBOOKS:** | |
|---|---|
| 1 | DavidH.Eberly,—3DGameEngineDesign:APracticalApproachtoReal-TimeComputer Graphics,SecondEdition,MorganKaufmann,2010. |
| 2 | Jung Hyun Han, —3D Graphics for Game Programming, First Edition, Chapman and Hall/CRC,2011. |
| **REFERENCEBOOKS:** | |
| 1 | JonathanS. Harbour,—Beginning Game Programming, Course Technology, Third Edition PTR,2009.. |
| 2 | Ernest Adams and Andrew Rollings, —Fundamentals of Game Design, Third Edition, PearsonEducation,2014. |
| 3 | ScottRogers,—LevelUp:TheGuidetoGreatVideoGameDesign,FirstEdition,Wiley, 2010. |
| 4 | Thompson,BarnabyBerbank-Green,andNicCusworth,—GameDesign:Principles,Practice, andTechniques-TheUltimateGuidefortheAspiringGameDesigner,FirstEdition,Wiley, 2008. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 2 | 3 | 2 | - |
| **CO2** | 2 | 1 | - | - | - | - | - | - | - | 1 | 3 | 3 | 1 | 1 | - |
| **CO3** | 3 | 1 | 1 | - | - | - | - | - | 1 | 1 | 2 | 2 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | 2 | 2 | 3 | 3 | 2 | 3 | - |
| **CO5** | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 2 | 3 | 2 | 2 | - |
| **Average** | **2.6** | **1.4** | **1** | **-** | **-** | **-** | **-** | **-** | **1.4** | **1.2** | **2.6** | **2.6** | **2** | **2** | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum Marks** | |
| **22AI15014** | **GRAPH THEORY AND APPLICATIONS** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn fundamentals of graph theory.<br>• Gain the basic properties of Trees.<br>• Familiarize the basic types of graph.<br>• Gain the proof techniques related to various concepts in graphs.<br>• Be exposed to the techniques of proofs and analysis. | | | | | | |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Illustrate the basic concepts of graphs.<br>• Describe the Tree terminologies.<br>• Discuss the properties, theorems and be able to prove theorems.<br>• Apply suitable graph model and algorithm for solving applications.<br>• Use a combination of theoretical knowledge and independent mathematical thinking in creative investigation of questions in graph theory. | | | | | | |
| **UNIT-I** | **BASIC CONCEPTS** | | | | | | **9** |
| Introduction- Graph Terminologies- Types of Graphs-Sub Graph-Multi Graph- Regular Graph-Isomorphism- Isomorphic Graphs- Sub-graph- Euler graph-Operation on Graph- Hamiltonian Graph-Travelling Salesman Problem-Related Theorems. | | | | | | | |
| **UNIT-II** | **TREE TERMINOLOGIES** | | | | | | **9** |
| Trees-Properties-Distance and Centers-Types-Rooted Tree—Tree Enumeration-Labeled Tree-Unlabeled Tree-Spanning Tree-Fundamental Circuits-Cut Sets-Properties-Fundamental Circuit and Cut-set-Connectivity Separability-Network Flows- RelatedTheorems. | | | | | | | |
| **UNIT-III** | **TYPES OF GRAPH** | | | | | | **9** |
| Network Flows-Planar Graph- Representation-Detection- Dual Graph- Geometric and Combinatorial Dual-Related Theorems-Digraph- Properties-Euler Digraph-Vector spaces of Graph. | | | | | | | |
| **UNIT-IV** | **VARIOUS REPRESENTATION AND CORRELATIONS** | | | | | | **9** |
| Matrix Representation- Adjacency matrix-Incidence matrix-Circuit matrix- Cut-set matrix-Path Matrix-Properties-Related Theorems-Correlations. Graph Coloring- Chromatic Polynomial-Chromatic Partitioning- Matching- Covering-Related Theorems. | | | | | | | |
| **UNIT-V** | **ALGORITHMS** | | | | | | 9 |

| | |
|---|---|
| Graph Algorithms-Some Basic Algorithms-Connectedness and Components-Spanning Tree-Fundamental Circuits-Cut Vertices-Directed Circuits-Shortest Path Algorithms-Depth First Search on a graph -Isomorphism- Operational Research -Miscellaneous Applications-. | |
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXTBOOKS:** | |
| 1 | Narsingh Deo,"Graph Theory with Application to Engineering and ComputerScience",Prentice-HallofIndiaPvt.Ltd,2003. |
| 2 | L.R.Foulds,"Graph Theory Applications", Springer, 2016. |
| **REFERENCES:** | |
| 1 | Bondy,J.A.and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication,2008. |
| 2 | West, D.B.,—Introduction to Graph Theory,Pearson Education,2011. |
| 3 | John Clark, Derek Allan Holton,—A First Look at Graph Theory, World Scientific Publishing Company,1991 |
| 4 | Diestel,R,"Graph Theory",Springer,3rdEdition,2006. |
| 5 | Kenneth H.Rosen,"Discrete Mathematics and Its Applications", Mc Graw Hill,2007. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 2 | 2 | 1 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 2 | 1 | 1 | - |
| **CO3** | 2 | 3 | 1 | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 2 | - |
| **CO4** | 2 | 1 | 2 | | - | - | - | - | - | - | **3** | **2** | 1 | 1 | - |
| **CO5** | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 3 | 2 | 1 | 1 | - |
| **Average** | **2.2** | **2** | **1.6** | **-** | **-** | **-** | **-** | **-** | **-** | **1.2** | 3 | 2 | **1** | **1** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**MAHENDRA ENGINEERING COLLEGE**
**(Autonomous)**

**Syllabus**

| **Department** | **Information Technology** | **Programme Code** | **2071** |
|---|---|---|---|

**Program Elective**

| **Course code** | **Course Name** | **Periods/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22AI15015** | **OPEN SOURCE SOFTWARE** | 3 | 0 | 0 | 3 | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Provide an overview of open source software and platforms.<br>• Be exposed to the context and operation of free and open source software (FOSS)<br>• Be familiar with participating in a FOSS project<br>• Learn scripting language like Python or Perl or R script.<br>• Learn some important FOSS tools and techniques |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Install and run open-source operating systems.<br>• Build and modify one or more Free and Open Source Software packages.<br>• Understand various version control systems.<br>• Contribute software to and interact with Free and Open Source Software development projects.<br>• Develop the some important of FOSS tools and techniques |

| **UNIT-I** | **INTRODUCTION** | 9 |
|---|---|---|

Introduction to Open sources – Need of Open Sources – Advantages of Open Sources– Application of Open Sources. Open source operating systems: LINUX: Introduction – General Overview – Kernel Mode and user mode – Process – Advanced Concepts – Scheduling – Personalities – Cloning– Signals – Development with Linux.

| **UNIT-II** | **OPEN SOURCE PROGRAMMING LANGUAGES - I** | 9 |
|---|---|---|

Perl backgrounder – Perl over view – Perl parsing rules – Variables and Data – Statements andControl structures – Subroutines, Packages, and Modules- Working with Files –Data Manipulation.

| **UNIT-III** | **PROGRAMMING LANGUAGES-II** | 9 |
|---|---|---|

PHP: Introduction – Programming in web environment – variables – constants – data types –operators – Statements – Functions – Arrays – OOP – String Manipulation and regular expression – File handling and data storage – PHP and SQL database – PHP and LDAP – PHP Connectivity – Sending and receiving E-mails – Debugging and error handling – Security – Templates.

| **UNIT-IV** | **PROGRAMMING LANGUAGES-III** | 9 |
|---|---|---|

R programming: History and Overview of R : Basic Features of R - Free Software- Design of the RSystem.R Nuts and Bolts: Entering Input – Evaluation- R Objects- Numbers- Creating Vectors- Matrices- Factors- Data Frames- Names. Getting Data In and Out of R- File Connections - Vectorized Operations- Control Structures- Functions.

| UNIT-V | Database Connectivity – MySQL: | 9 |
|---|---|---|
| Connecting to MySQL – Queries – Fetching Data Sets – Data About Data – Multiple Connections – Creating MySQL Databases with PHP – MySQL Functions – HTML Tables and Database Tables – Complex Mappings – Creating the Sample Tables. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS:** | |
|---|---|
| 1 | Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", Sixth Edition, OReilly Media, 2009. |
| 2 | Roger P Deng, "R programming for Data Science" ,First Edition,2015. |
| **REFERENCES:** | |
| 1 | StevenHolzner,"PHP:TheCompleteReference",2ndEdition,TataMcGraw-Hill PublishingCompanyLimited,IndianReprint2009. |
| 2 | PhilosophyofGNUURL:http://www.gnu.org/philosophy/. |
| 3 | LinuxAdministrationURL: http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/. |
| 4 | The Python Tutorial available at http://docs.python.org/2/tutorial/.Elsevier, Second Edition. |
| 5 | Perl Programming book at http://www.perl.org/books/beginning-perl/. |
| 6 | R programming book at http://leanpub.com/rprogramming |
| 7 | Version control system URL: http://git-scm.com/.<br>Samba: URL : http://www.samba.org/. and Libre office: http://www.libreoffice.org/. |

### COs Vs POs and PSOs Mapping

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | - | 1 | 3 | 3 | 1 | 2 | - |
| **CO4** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO5** | 3 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 3 | 1 | 1 | - |
| **Average** | **3** | **2** | **1.8** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | **3** | **3** | **1.6** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/Week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15016** | **IMAGE PROCESSING** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• To learn the basic concepts of digital image processing and various image transforms<br>• To familiarize the student with the image enhancement techniques.<br>• To expose the student to a broad range of image processing techniques and their applications<br>• To appreciate the use of current technologies that are specific to image processing systems.<br>• To expose the students to real-world applications of image processing. | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Implement basic image processing operations.<br>• Apply and develop new techniques in the areas of image enhancement and restoration<br>• Understand the image segmentation algorithms and extract features from images<br>• Apply classifiers and clustering algorithms for image classification and clustering<br>• Design and develop an image processing application that uses different concepts of image processing | | | | | |
| **UNIT-I** | **FUNDAMENTALS OF IMAGE PROCESSING** | | | | | 9 |
| Introduction – Applications of Image Processing – Steps in Image Processing Applications – Digital Imaging System – Sampling and Quantization – Pixel Connectivity – Distance Measures – Colour Fundamentals and Models – File Formats – Image Operations. | | | | | | |
| **UNIT-II** | **IMAGE ENHANCEMENT** | | | | | 9 |
| Image Transforms: Discrete Fourier Transform – Fast Fourier Transform – Discrete Cosine Transform – Image Enhancement in Spatial and Frequency Domain – Grey Level Transformations – Histogram Processing –Spatial Filtering – Smoothing And Sharpening – Frequency Domain: Filtering in Frequency Domain | | | | | | |
| **UNIT-III** | **IMAGE RESTORATION AND MULTI-RESOLUTION ANALYSIS** | | | | | 9 |
| Multi Resolution Analysis: Image Pyramids – Multi Resolution Expansion – Wavelet Transforms – Image Restoration – Image Degradation Model – Noise Modeling – Blur – Order Statistic Filters – Image Restoration Algorithms. | | | | | | |

| UNIT-IV | IMAGE SEGMENTATION AND FEATURE EXTRACTION | 9 |
|---|---|---|
| Image Segmentation – Detection of Discontinuities –Edge Operators –Edge Linking and Boundary Detection – Thresholding – Region based Segmentation – Image Features and Extraction – Image Features – Types of Features – Feature extraction – SIFT, SURF and Texture – Feature reduction algorithms.. | | |
| **UNIT-V** | **IMAGE PROCESSING APPLICATIONS** | 9 |
| Image Classifiers – Supervised Learning – Support Vector Machines, Image Clustering – Unsupervised Learning – Hierarchical and Partition based Clustering Algorithms – EM Algorithm. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS :** | |
|---|---|
| 1 | Rafael Gonzalez, Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson Education, 2018 |
| 2 | S. Sridhar, "Digital Image Processing", Second Edition, Oxford University Press, 2016. |
| **REFERENCES:** | |
| 1 | Anil K. Jain, "Fundamentals of Digital Image Processing", PHI, 2011. . |
| 2 | Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing Analysis and Machine Vision", Fourth Edition, Cengage India, 2017. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | 2 | 3 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | 2 | 1 | 3 | 3 | 2 | 3 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | 2 | 2 | 3 | 3 | 2 | 2 | - |
| **Average** | **3** | **2** | **1.2** | **-** | **-** | **-** | **-** | **-** | **1.6** | **1** | **2.8** | **3** | **2.4** | **2.2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**MAHENDRA ENGINEERING COLLEGE**
**(Autonomous)**

**Syllabus**

| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | **1161** |
|---|---|---|---|

**Program Elective**

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum Marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22AI15017** | **HEALTH CARE INFORMATICS** | 3 | 0 | 0 | 3 | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to** :<br>• Learn machine learning and deep learning algorithms for health data analysis<br>• Learn the significance and need of data analysis and data visualization<br>• Understand the health data management frameworks<br>• Learn the use of machine learning and deep learning algorithms in healthcare<br>• Apply healthcare analytics for critical care applications |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Use machine learning and deep learning algorithms for health data analysis<br>• Apply the data management techniques for healthcare data<br>• Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications<br>• Design health data analytics for real time applications<br>• Design emergency care system using health data analysis |

| **UNIT-I** | **INTRODUCTION TO HEALTH CARE ANALYSIS** | **9** |
|---|---|---|

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.

| **UNIT-II** | **ANALYTICS ON MACHINE LEARNING** | **9** |
|---|---|---|

Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection.

| **UNIT-III** | **HEALTH CARE MANAGEMENT** | **9** |
|---|---|---|

IOT- Smart Sensors – Migration of Health care 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.

| **UNIT-IV** | **HEALTH CARE AND DEEP LEARNING** | **9** |
|---|---|---|

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.

| UNIT-V | CASE STUDIES | 9 |
|---|---|---|
| Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis. | | |
| | **TOTAL HOURS** | **45** |

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

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 1 | 2 | - |
| **CO4** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 2 | 2 | 1 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **Average** | **3** | **2** | **1.2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2.8** | **2.8** | **1.6** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum Marks** | |
| **22AI15018** | **BLOCKCHAIN TECHNOLOGY** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to** :<br>• Familiarize the Blockchain's fundamental components, and examine decentralization using block chain.<br>• To explain how crypto currency works, from when a transaction is created to when it is considered part of the Blockchain.<br>• To explain the components of Ethereum and Programming Languages for Ethereum.<br>• To study the basics of Hyperledger and Web3.<br>• To know about alternative Blockchains and Blockchain projects in different domains. | | | | | | |
| **Outcome(s)** | **On completion of the course, the students will be able to:**<br>• Explain the technology components of Blockchain and how it works behind the scenes.<br>• Identify different approaches to developing decentralized applications.<br>• Discuss Bitcoin and its limitations by comparing with other alternative coins.<br>• Devise solution using the Ethereum model.<br>• Explain the use of Hyperledger and its development framework. | | | | | | |
| **UNIT-I** | **INTRODUCTION TO BLOCKCHAIN** | | | | | | 9 |
| History of Blockchain – Types of Blockchain – Consensus –Transactions and Blocks, P2P Systems, Keys as Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain. Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization. | | | | | | | |
| **UNIT-II** | **BITCOIN AND CRYPTOCURRENCY** | | | | | | 9 |
| Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets –Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency-Smart Contracts – Ricardian Contracts. | | | | | | | |
| **UNIT-III** | **ETHEREUM** | | | | | | 9 |
| The Ethereum Network – Components of Ethereum Ecosystem –Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers- Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language. | | | | | | | |

| UNIT-IV | WEB3 AND HYPERLEDGER | 9 |
|---|---|---|
| Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda. | | |
| **UNIT-V** | **ALTERNATIVE BLOCKCHAINS AND APPLICATIONS** | 9 |
| Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy –Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOK:** | |
|---|---|
| 1. | Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018. |
| 2. | Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016 |
| **REFERENCES:** | |
| 1 | Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT, 2017. |
| 2 | Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O'Reilly, 2014. |
| 3 | Roger Wattenhofer, "The Science of the Blockchain" CreateSpace Independent Publishing, 2016. |
| 4 | A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016. |
| 5 | Alex Leverington, "Ethereum Programming" Packt Publishing, 2017. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 1 | - | - | - | - | - | - | 1 | 3 | 3 | 1 | 2 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | - | 1 | 2 | 3 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | - | 2 | 3 | 3 | 2 | 1 | - |
| **CO5** | 3 | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 3 | 2 | 2 | - |
| **Average** | **3** | **2** | **1.4** | **-** | **-** | **-** | **-** | **-** | **-** | **1.2** | **2.6** | **3** | **2** | **1.8** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence and Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/Week** | | | **Credit** | **Maximum marks** | |
| **22AI15019** | **OBJECT ORIENTED ANALYSIS AND DESIGN** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to** :<br>• Learn the fundamentals of object modeling<br>• Familiarize differentiate Unified Process from other approaches.<br>• Design with the UML dynamic and implementation diagrams.<br>• Improve the software design with design patterns.<br>• Test the software against its requirements specification | | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Express software design with UML diagrams<br>• Design software applications using OO concepts.<br>• Identify various scenarios based on software requirements<br>• Transform UML based software design into pattern based design using design patterns<br>• Describe the various testing methodologies for OO software | | | | | | |
| **UNIT-I** | **UNIFIED PROCESS AND USE CASE DIAGRAMS** | | | | | | 9 |
| Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –Case study – the Next Gen POS system, Inception -Use case Modeling – Relating Use cases – include, extend and generalization – When to use Use-casesuse Class Diagrams. | | | | | | | |
| **UNIT-II** | **STATIC UML DIAGRAMS** | | | | | | 9 |
| Class Diagram – Elaboration - Domain Model –Finding conceptual and description classes – Associations - Attributes – Domain model refinement – finding conceptual class hierarchies – Aggregation and composition – Relationship between sequence diagrams and use cases – when use class diagrams. | | | | | | | |
| **UNIT-III** | **DYNAMIC AND IMPLEMENTATION UML DIAGRAMS** | | | | | | 9 |
| UML interaction diagrams - System sequence diagram–Collaboration diagram– When to use Communication Diagrams - State machine diagram and Modeling –When to use S a Diagrams - Activity diagram – When to use activity diagrams- Implementation Diagrams- UML package diagram - When to use package diagrams - ComponentandDeploymentDiagrams– WhentouseComponentandDeploymentdiagrams. | | | | | | | |
| **UNIT-IV** | **DESIGNPATTERNS** | | | | | | 9 |
| GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller - Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioral – Strategy – observer –Applying GoF design patterns – Mapping design to code. | | | | | | | |

| UNIT-V | TESTING | 9 |
|---|---|---|
| Object Oriented Methodologies – Software Quality Assurance – In act of object orientation on Testing – Develop Test Cases and Test Plans. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS:** | |
|---|---|
| 1 | Craig Larman, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Third Edition, Pearson Education, 2005. |
| 2 | Ali Bahrami - Object Oriented Systems Development - McGraw Hill International, Edition – 1999. |
| **REFERENCES:** | |
| 1 | Erich Gamma, and Richard Helm, Ralph Johnson, John Vlissides, ―Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995 |
| 2 | Martin Fouler, ―UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2003. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 1 | - | - | - | - | - | - | - | - | 2 | 3 | 1 | 2 | - |
| **CO4** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO5** | 3 | 1 | 2 | - | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **Average** | **3** | **1.6** | **1.2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2.8** | **3** | **1.6** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

# MAHENDRA ENGINEERING COLLEGE
**(Autonomous)**

## Syllabus

| Department | Artificial Intelligence & Data Science | Programme Code | 1161 |
|---|---|---|---|

**Program Elective**

| Course code | Course Name | Hours/week | | | Credit | Maximum marks |
|---|---|---|---|---|---|---|
| | | L | T | P | C | |
| 22AI15020 | ADVANCED JAVA PROGRAMMING | 3 | 0 | 0 | 3 | 100 |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Learn the concepts of interfaces, threads, and swings using Java<br>• Learn how to establish network connectivity and write socket programming in Java<br>• Expose to develop client side programming in Java<br>• Expose to develop server side programming in Java<br>• Learn how to handle data from databases in java |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Explain the main concepts of interfaces, threads and swings in Java<br>• Construct network connectivity using sockets and share data across networks<br>• Develop client side programs in Java<br>• Develop server side programs in Java<br>• Create applications using java and perform data handling operations in database |

| **UNIT-I** | **JAVA FUNDAMENTALS** | **9** |
|---|---|---|

Java I/O streaming – filter and pipe streams – Byte Code interpretation - Threading – Swing.

| **UNIT-II** | **NETWORK PROGRAMMING IN JAVA** | **9** |
|---|---|---|

Sockets – secure sockets – custom sockets – UDP datagrams – multicast sockets – URL classes – Reading Data from the server – writing data – configuring the connection – Reading the header – telnet application – Java Messaging services

| **UNIT-III** | **CLIENT SIDE PROGRAMMING** | **9** |
|---|---|---|

Client- Server computing – Sockets – Content and Protocols handlers – Developing distributed applications –RMI – Remote objects – Object serialization

| **UNIT-IV** | **SERVER SIDE PROGRAMMING** | **9** |
|---|---|---|

Introduction to Java Servlets – Overview and Architecture – Handling HTTP get &post request – Session Tracking – Multi-tier application - Implicit objects –Scripting – Standard actions – Directives – Custom Tag libraries

| UNIT-V | JAVA DATABASE PROGRAMMING | 9 |
|---|---|---|
| Connecting to Databases – JDBC principles – Databases access – Interacting –Database search – Accessing Multimedia databases – Database support in Web applications. | | |
| | **TOTAL HOURS** | **45** |

**TEXT BOOK :**

| | |
|---|---|
| 1 | Herbert Schildt, "Java The Complete Reference", McGraw-Hill Publications,2011 |
| 2 | Elliotte Rusty Harold, "Java Network Programming", O'Reilly publishers, 2004 |
| 3 | Hortsmann& Cornell, "CORE JAVA 2 ADVANCED FEATURES, VOL II", Pearson Education, 2002.. |

**REFERENCES:**

| | |
|---|---|
| 1 | Kogent solution Inc, "Java 6 Programming Black Book", Dreamtech press ,2007 |
| 2 | Deital and Deital, Goldberg, "Internet &World Wide Web, How To Program". Fourth Edition, Prentice Hall, 2009 |
| 3 | Deitel M. and Deitel P.J., "Java how to program", Prentice Hall, Eighth Edition, 2009. |
| 4 | Cay.S.Horstmann, Gary Cornell, " Core Java Volume –II Advanced Features",Prentice Hall, Eighth Edition, 2008. |
| 5 | Campione, Walrath and Huml, "The Java Tutorial", Addison Wesley, 2003. |
| 6 | Duane A.Bailey, "Java Structures", McGraw-Hill Publications, 2007. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 1 | - |
| **CO3** | 3 | 1 | - | - | - | - | - | - | - | - | 2 | 3 | 3 | 2 | - |
| **CO4** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO5** | 3 | 1 | - | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **Average** | **3** | **1.6** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2.8** | **3** | **3** | **1.8** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence and Data Science** | **ProgrammeCode** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/Week** | | | **Credit** | **Maximum marks** | |
| **22AI15021** | **SOFTWARE ENGINEERING** | **L** | T | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn the phases in a software project<br>• Familiarize the fundamental concepts of requirements engineering and Analysis Modeling.<br>• Gain the major considerations for enterprise integration and deployment.<br>• Learn various testing and maintenance measures | | | | | | |
| **Outcome(s)** | **Upon completion of this course, students will be able to:**<br>• Identify the key activities in managing a software project.<br>• Compare different process models.<br>• Concepts of requirements engineering and Analysis Modeling.<br>• Apply systematic procedure for software design and deployment.<br>• Compare and contrast the various testing and maintenance. | | | | | | |
| **UNIT-I** | **SOFTWARE PROCESS AND AGILE DEVELOPMENT** | | | | | | **9** |
| Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –-Classical Evolutionary models-Introduction to Agility-Agile process-Extreme programming-XP Process-Over view of System Engineering | | | | | | | |
| **UNIT-II** | **REQUIREMENTS ANALYSIS AND SPECIFICATION** | | | | | | **9** |
| Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Structured system Analysis, Petri Nets-Data Dictionary | | | | | | | |
| **UNIT-III** | **SOFTWARE DESIGN** | | | | | | **9** |
| Design process – Design Concepts-Design Model– Refinement-Modularity Cohesion coupling– Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components. | | | | | | | |
| **UNIT-IV** | **SOFTWARE IMPLEMENTATION AND MAINTENANCE** | | | | | | **9** |
| Structured coding Techniques-Coding Styles-Standards and Guidelines- Documentation Guidelines-Modern Programming Language Features: Type checking-User defined data types-Data Abstraction-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering | | | | | | | |
| **UNIT-V** | **PROJECT MANAGEMENT** | | | | | | **9** |
| Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – | | | | | | | |

| | |
|---|---|
| Project Plan, Planning Process, RFP Risk Management – Identification, Projection, and Refinement-Reactive Vs proactive risk strategies-Risk Identification-RMMM Plan-CASE TOOLS | |
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOK :** | |
| 1 | Roger S. Pressman, "Software Engineering – A Practitioner‟s Approach", Seventh Edition, McGraw-Hill International Edition, 2010 |
| **REFERENCES:** | |
| 1 | Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011 |
| 2 | Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited ,2009 |
| 3 | PankajJalote, "Software Engineering, A Precise Approach", Wiley India, 2010 |
| 4 | Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007 |
| 5 | Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007. |
| 6 | http://nptel.ac.in/. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | 1 | 3 | 3 | 1 | 2 | - |
| **CO3** | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 2 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | - | 2 | 3 | 3 | 2 | 1 | - |
| **CO5** | 3 | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 3 | 2 | 2 | - |
| **Average** | **3** | **2** | **1.4** | **-** | **-** | **-** | **-** | **-** | **-** | **1.2** | **2.6** | **2.8** | **2** | **1.8** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum Marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15022** | **DATA WAREHOUSING AND DATAMINING** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• To understand data warehouse concepts, architecture, business analysis and tools<br>• To understand data pre-processing and data visualization techniques.<br>• To study algorithms for finding hidden and interesting patterns in data.<br>• To understand and apply various classification and clustering techniques using tools.<br>• Study about heuristic search techniques. | | | | | |
| **Outcome(s)** | **Upon completion of this course, students will be able to**<br>• Design a Data warehouse system and perform business analysis with OLAP tools.<br>• Apply suitable pre-processing and visualization techniques for data analysis<br>• Apply frequent pattern and association rule mining techniques for data analysis<br>• Apply appropriate classification and clustering techniques for data analysis.<br>• Use appropriate search algorithms for problem solving. | | | | | |
| **UNIT-I** | **DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINEAR ANALYTICAL PROCESSING** | | | | | **9** |
| Basic Concepts–Data Warehousing Components–Building a Data Warehouse–Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data warehouse Schemas for Decision Support, Concept Hierarchies-Characteristics of OLAP Systems–OLAP and OLTP. | | | | | | |
| **UNIT-II** | **DATAMINING–INTRODUCTION** | | | | | **9** |
| Introduction to Data Mining Systems–Knowledge Discovery Process–Data Mining Techniques–Issues–Applications-Data Objects and Attribute types, Statistical description of data, Data Preprocessing–Cleaning-Integration-Reduction-Transformation and discretization – Data Visualization- Data similarity and dissimilarity measures. | | | | | | |
| **UNIT-III** | **DATAMINING–FREQUENT PATTERN ANALYSIS** | | | | | **9** |
| Mining Frequent Patterns, Associations and Correlations–Mining Methods-Pattern Evaluation Method– Pattern Mining in Multilevel-Multi Dimensional Space–Constraint Based Frequent Pattern Mining-Classification using Frequent Patterns. | | | | | | |

| UNIT-IV | CLASSIFICATION AND CLUSTERING | 9 |
|---|---|---|
| Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines–Model Evaluation and Selection-Techniques to improve Classification Accuracy-Clustering Techniques – Cluster analysis-Partitioning Methods– Hierarchical Methods–Density Based Methods–Grid Based Methods. | | |
| **UNIT-V** | **INTRODUCTION TO AI** | **9** |
| Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP). | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS:** | |
|---|---|
| 1 | JiaweiHanandMichelineKamber,—DataMiningConceptsandTechniques,Third Edition, Elsevier, 2012. |
| 2 | Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021. |
| **REFERENCES:** | |
| 1 | AlexBersonandStephenJ.Smith,—DataWarehousing,DataMining&OLAP,Tata McGraw–Hill Edition,35th Reprint2016. |
| 2 | K.P.Soman,Shyam Diwakar and V.Ajay,—Insight into DataMining Theory and Practice,Eastern Economy Edition,Prentice Hall of India,2006. |
| 3 | IanH.Wittenand Eibe Frank,—DataMining:Practical Machine Learning Tools and Techniques, Elsevier, Second Edition. |
| 4 | https://nptel.ac.in/courses/106105174/data mining |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | 2 | 1 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 2 | - | - | - | - | - | - | 1 | 1 | 3 | 3 | 3 | - | - |
| **CO4** | 3 | 1 | 2 | | - | - | - | - | 2 | - | 3 | 2 | 3 | 2 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | 1 | - | 3 | 3 | 3 | 2 | - |
| **Average** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **2** | **-** | **3** | **2.8** | **3** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/Week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15023** | **R Programming** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Establish an efficient scientific computing environment<br>• Identify the available R packages as open source software<br>• Gain the Data visualization in R programming<br>• Design an efficient programs using R for data manipulation<br>• Collaborate on code development using a suite of Open Source standards and tools | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Explain critical R programming concepts<br>• Demonstrate how to install and configure data frame in R Studio<br>• Apply OOP concepts in R programming<br>• Explain the use of data structure and loop functions<br>• Analyze data and generate reports based on the data | | | | | |
| **UNIT-I** | **R INTRODUCTION** | | | | | 9 |
| Overview of R Programming - Downloading and installing - Help of Function - Viewing documentation - General issues in R - Package Management | | | | | | |
| **UNIT-II** | **DATA INPUTTING IN R** | | | | | 9 |
| Data Types - Subsetting - Writing data - Reading from csv files - Creating a vector and vector operation - Initializing data frame - Control structure - Re-directing R Output | | | | | | |
| **UNIT-III** | **DATA VISUALIZATION AND BASIC STATICS** | | | | | 9 |
| Creating bar chart and dot plot - Creating histogram and box plot - Plotting with base graphics - Plotting and coloring in R - Computing Basic Statistics - Comparing means of two samples - Testing a proportion - Data Munging Basics | | | | | | |
| **UNIT-IV** | **FUNCTIONS AND DATA MANIPULATION IN R** | | | | | 9 |
| Flow control: For loop - If condition - Debugging tools - List Management - Data Transformation - Merging Data Frames - Outlier Detection - Combining multiple vectors | | | | | | |
| **UNIT-V** | **DATABASE AND STATISTICAL MODELLING IN R** | | | | | 9 |
| Performing queries - RODBC and DBI Package - Advanced Data handling - Combined and restructuring data frames - Logical Regression - Hierarchical Clustering PCA for Dimensionality Reduction | | | | | | |
| | | | | | **TOTAL HOURS** | **45** |

| TEXT BOOKS: | |
|---|---|
| 1 | R for Data Science: Import, Tidy, Transform, Visualize, and Model Databy Hadley Wickham, publisher O′Reilly; 1st edition (20 January 2017). |
| 2 | R Programming for Data SciencebyRoger D. Peng,2020-09-03 |
| **REFERENCES:** | |
| 1 | Advanced R by Hadley Wickham |
| 2 | An Introduction to Statistical and Data Sciences via R, Chester Ismay and Albert Y. Kim |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 3 | 3 | - |
| **CO2** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 3 | - | - |
| **CO3** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 3 | 2 | - |
| **CO4** | 2 | 2 | - | 2 | 2 | - | - | - | - | - | 1 | 1 | 3 | - | - |
| **CO5** | 1 | 2 | - | - | 1 | - | - | - | - | - | 1 | - | 2 | 2 | - |
| **Average** | **2.4** | **2.6** | **1.8** | **1.8** | **1.8** | **-** | **-** | **-** | **-** | **-** | **1.6** | **1** | **2.8** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours /Week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15024** | **KNOWLEDGE ENGINEERING** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Learn the fundamentals of Knowledge Engineering and Intelligent Systems.<br>• Provide deep understanding of Knowledge Engineering and Intelligent Systems<br>• Gain the knowledge about all aspect of advanced models of Knowledge Engineering and Its applications.<br>• Learn knowledge management in different organizations.<br>• Gain the learning and rule learning. | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Demonstrate the knowledge of fundamental elements and concepts related to Intelligent Systems<br>• Demonstrate the fundamental and advanced modules of Knowledge Engineering especially with Searching methods, Representation of knowledge and different reasoning techniques.<br>• Ability to work with Predicate logic, back propagation with respect to the CNNs model parameters and implementing the models successfully.<br>• Apply the higher order logics for handling uncertainty<br>• Understand learning and rule learning | | | | | |
| **UNIT-I** | **KNOWLEDGE ENGINEERING CONCEPTS** | | | | | **9** |
| Definition of Knowledge Engineering – Knowledge base Systems – Knowledge base systems Vs Database systems – Rules Vs Triggers – Domain Expert – Expert Systems –Heuristic Search – A*, AO* and Mini-max algorithms - Knowledge representation – Semantic Networks – Frames- Conceptual Dependency – Scripts – Ontology – Semantic Web– Reasoning Methods | | | | | | |
| **UNIT-II** | **FIRST ORDER LOGIC** | | | | | **9** |
| Role of Logic –Propositional logic – Predicate logic – Syntax – Semantics – Interpretations – Denotation – Satisfaction and models – Pragmatics – Explicit and Implicit Beliefs - Logical Consequence – Expressing Knowledge - Basic and Complex Facts – Terminological facts – Entailment –Abstract Individuals - Other Sorts of Facts –Resolution – The Propositional Case – Predicate Logic. | | | | | | |
| **UNIT-III** | **KNOWLEDGE REPRESENTATION – USING RULES** | | | | | **9** |
| Procedural Versus Declarative Knowledge - Logic Programming - Forward versus Backward Reasoning – Rule Matching – Rules in Production Systems- Working Memory- Conflict Resolution- Rete's Algorithm – Discriminate Networks - Control Knowledge –Reasoning with Horn Clauses – Rule Formation and Search Strategy – Algorithm Design – Specifying Goal order – Committing to Proof methods – Controlling Back Tracking – Negation as Failure – Dynamic Databases. | | | | | | |

| UNIT-IV | OBJECT ORIENTED REPRESENTATION USING LOGIC | 9 |
|---|---|---|
| Object oriented Representation – Objects and Frames – Frame Formalism –Object Driven Programming with Frames – Generic and Individual Frames – Inheritance – Reasoning with Frames – Structured Descriptions – Descriptions – Description Language – Meaning and Entailment – Interpretations – Truth in an Interpretation –Computing Entailments – Simplifying the Knowledge base – Normalization – Structure Matching | | |
| **UNIT-V** | **LEARNING AND RULE LEARNING** | **9** |
| Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modeling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS :** | |
|---|---|
| 1 | Ronald J.Brachman, Hector Levesque, Knowledge Representation and Reasoning, 1 st Edition, Morgan Kaufmann, 2004 2. |
| 2 | Richard A Frost, "Introduction to Knowledge Based Systems", Macmillan Publishing Co, 1986. |
| 3 | John F. Sowa, Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks Cole Publishing Co., Pacific Grove, CA, 2000 |
| 4 | Building Intelligent SystemsA Guide to Machine Learning Engineering, Authors: Hulten, Geoff, Apress; 1st ed. edition (2018) |
| **REFERENCES:** | |
| 1 | Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", Third Edition, Tata McGraw-Hill Education Pvt. Ltd., 2010.. |
| 2 | Donald A Waterman,"A Guide to Expert Systems", Addison Wesley, 1986. |
| 3 | Schall, Daniel,"Social Network-Based Recommender Systems", Springer, 2015. |
| 4 | King , Knowledge Management and Organizational Learning , Springer, 2009. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 3 | 3 | - |
| **CO2** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 2 | 3 | - | - |
| **CO3** | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | - | 3 | 2 | - |
| **CO4** | 2 | 2 | - | 2 | 2 | - | - | - | - | - | 1 | 1 | 3 | - | - |
| **CO5** | 1 | 2 | - | - | 1 | - | - | - | - | - | 1 | - | 2 | 2 | - |
| **Average** | **2.4** | **2.6** | **1.8** | **1.8** | **1.8** | **-** | **-** | **-** | **-** | **-** | **1.6** | **1** | **2.8** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours /Week** | | | **Credit** | **Maximum marks** | |
| **22AI15025** | **DISTRIBUTED DATABASE** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn the design of databases<br>• Acquire knowledge distributed databases and its applications<br>• Familiarize advanced concepts in databases in large scale analytics<br>• Learn reasoning and query processing<br>• Learn the challenges in distributed databases | | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to:**<br>• Explain theoretical and practical aspects of distributed database systems<br>• Identify various issues related to the development of distributed database system.<br>• Discuss the design aspects of object-oriented database system and related development.<br>• Critically analyze the state-of-the-art in advanced databases distributed systems.<br>• Apply problem solving (analysis, design, and development) skills to distributed Applications | | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | | **9** |
| Introduction: Distributed Data Processing - Distributed Database System - Promises of DDBSs - Problem areas. Distributed DBMS Architecture: Architectural Models for Distributed DBMS - DMBS Architecture. Distributed Database Design: Alternative Design Strategies - Distribution Design issues – Fragmentation - Allocation. | | | | | | | |
| **UNIT-II** | **QUERY PROCESSING AND DECOMPOSITION** | | | | | | **9** |
| Query processing and decomposition: Query processing objectives - characterization of query processors - layers of query processing - query decomposition - localization of distributed data. Distributed query Optimization: Query optimization - centralized query optimization - distributed query optimization algorithms. | | | | | | | |
| **UNIT-III** | **TRANSACTION MANAGEMENT** | | | | | | **9** |
| **Transaction Management:** Definition - properties of transaction - types of transactions - distributed concurrency control: Serializability - concurrency control mechanisms & algorithms - time - stamped & optimistic concurrency control Algorithms - deadlock Management. | | | | | | | |

| UNIT-IV | DISTRIBUTED DBMS RELIABILITY | 9 |
|---|---|---|
| Distributed DBMS Reliability: Reliability concepts and measures - fault-tolerance in distributed systems - failures in Distributed DBMS - local & distributed reliability protocols - site failures and network partitioning. Parallel Database Systems: Parallel database system architectures - parallel data placement - parallel query processing - load balancing - database clusters. | | |
| **UNIT-V** | **DISTRIBUTED OBJECT DATABASE MANAGEMENT SYSTEMS** | **9** |
| Distributed object Database Management Systems: Fundamental object concepts and models - object distributed design - architectural issues - object management - distributed object storage - object query Processing. Object Oriented Data Model: Inheritance - object identity - persistent programming languages - persistence of objects - comparison OODBMS and ORDBMS. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS :** | |
|---|---|
| 1 | M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001. |
| 2 | Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, McGraw Hill. |
| **REFERENCES:** | |
| 1 | Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO4** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **Average** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** | |
| **22AI15026** | **DATA VISUALIZATION** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn about the visualization process and data foundation.<br>• Familiarize the visualization of spatial data and combining techniques.<br>• Familiarize with tree,graphics and networks.<br>• Learn the problems in Designing Effective<br>• Able to work with different formats of data sets. | | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to**:<br>• Interpret principles of visual perception.<br>• apply visualization techniques for various data analysis tasks – numerical data<br>• Apply visualization techniques for the applications using unstructured data.<br>• Demonstrate effective visualization techniques for different problems.<br>• Employ information dashboard for Sales and marketing analysis. | | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | | **9** |
| Introduction: Visualization – visualization process – role of cognition – Pseudo code conventions – Scatter plot - Data foundation: Types of data - Structure within and between records - Data preprocessing – Human perceptions and information processing – Visualization foundations. | | | | | | | |
| **UNIT-II** | **SPATIAL AND GEOSPATIAL,TIME ORIENTED DATA AND MULTIVARIATE DATA** | | | | | | **9** |
| Spatial and Geospatial, Time oriented data and Multivariate data: one, two, three dimensional data – Dynamic data – Combining techniques- Visualization of spatial data - Visualization of point data - Visualization of line data - Visualization of area data - Issues in Geospatial data Visualization – Characterizing and visualizing Time oriented data- Point, Line ad region based techniques for multivariate data. | | | | | | | |
| **UNIT-III** | **TREE,GRAPH,NETWORKS,TEXT AND DOCUMENT** | | | | | | **9** |
| Tree, Graph, Networks, Text and Document: Displaying hierarchical structure – Displaying Arbitrary Graphs/Networks – Other issues. Visualization techniques for Tree- Graph and Networks - Levels of text representation – Vector space model – Single Document Visualization – Document collection visualization- Extended text visualization. | | | | | | | |
| **UNIT-IV** | **DESIGNING EFFECTIVE VISUALIZATION** | | | | | | **9** |
| Designing Effective Visualization: Steps in Designing Visualization – problems in Designing Effective Visualization – Comparing and evaluating visualization techniques – Visualization Systems. | | | | | | | |

| UNIT-V | INFORMATION DASHBOARD DESIGN | 9 |
|---|---|---|
| Information Dashboard Design: Characteristics of dashboards – Key goals in visual design process – Dashboard display media – Designing dashboards for usability – Meaningful organization – Maintaining consistency – Aesthetics of dashboards – Testing for usability – Case Studies: Sales dashboard, Marketing analysis dashboard. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS:** | |
|---|---|
| 1 | Matthew O. Ward. , Georges Grinstein and Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2 Edition, CRC Press, 2015 for Units I,II,III,IV. |
| **REFERENCES:** | |
| 1 | Stephen Few, "Information Dashboard Design: The Effective Visual Communication of Data", 1 Edition, O'Reilly Media, 2006 for |
| 2 | . Stephen Few, "Now you see it: Simple Visualization Techniques for Quantitative Analysis", 7 Edition, Analytics Press, 2009. |
| 3 | Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", 1 Edition, O'Reilly Media, 2008. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | 2 | 1 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 2 | - | - | - | - | - | - | 1 | 1 | 3 | 3 | 3 | - | - |
| **CO4** | 3 | 1 | 2 | | - | - | - | - | 2 | - | 3 | 2 | 3 | 2 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | 1 | - | 3 | 3 | 3 | 2 | - |
| **Average** | **3** | **2** | **2** | **-** | **-** | **-** | **-** | **-** | **2** | **-** | **3** | **2.8** | **3** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15027** | **AI FOR ROBOTICS** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Gain the fundamental concepts of AI in robotics<br>• Major paradigms for achieving<br>• Explain reactive paradigm<br>• Learn the knowledge about Robot Kinematics,<br>• Describes the dynamics, sensor and vision system | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Interpret the features of an industrial robots with end effectors<br>• Identify the characteristics of Autonomy Robot and use Hierarchical Paradigm for organizing intelligence in Robots.<br>• Apply reactive paradigm for AI Robots<br>• Perform kinematic and dynamic analyses with simulation<br>• Apply sensor and vision system for robots | | | | | |
| **UNIT-I** | **INTRODUCTION TO ROBOTICS** | | | | | 9 |
| Types and components of a robot- Classification of robots - Closed loop and open loop control systems. Kinematics systems: Definition of mechanisms and manipulators- Social issues and safety | | | | | | |
| **UNIT-II** | **AUTONOMY ROBOT AND HIERARCHICAL PARADIGM** | | | | | 9 |
| Overview –Use of Robots – Teleoperation - Areas of AI. Hierarchical Paradigm: Attributes of the Hierarchical Paradigm - Closed World Assumption - Representative Architectures - Advantages and Disadvantages | | | | | | |
| **UNIT-III** | **REACTIVE PARADIGM** | | | | | 9 |
| Overview - Reflexive behaviors - Coordination and Control of Behaviors - Perception in Behaviors - Schema Theory - Principles and Issues in Transferring Insights to Robots - Attributes of Reactive Paradigm - Subsumption Architecture - Potential Fields Methodologies - Evaluation of Reactive Architectures. | | | | | | |
| **UNIT-IV** | **ROBOT KINEMATICS AND DYNAMICS** | | | | | 9 |
| Kinematic Modelling: Translation and rotation representation- Coordinate transformation- DH parameters- Jacobian-Singularity and Statics. Dynamic Modelling: Equations of motion- Euler-Lagrange formulation. | | | | | | |

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| **UNIT-V** | **SENSORS AND VISION SYSTEM** | 9 |
| Sensor: Contact and Proximity, Position, Velocity, Force, Tactile. Introduction to Cameras- Camera calibration- Geometry of image formation- Euclidean-Similarity-Affine-Projective transformations- Vision applications in robotics. | | |
| | **TOTAL HOURS** | **45** |

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|---|---|
| **TEXT BOOKS:** | |
| 1 | Ronald C. Arkin, Robin R. Murphy, "An Introduction to AI Robotics", 1st edition, MIT Press, USA, 2001, for Units 1, 2 |
| 2 | Saha S.K., "Introduction to Robotics", 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014, for Units 3, 4, 5 |
| **REFERENCES:** | |
| 1 | Niku Saeed B., "Introduction to Robotics: Analysis", PHI Learning, New Delhi, 2011. |
| 2 | Ghosal A., "Robotics", Oxford, New Delhi, 2006 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | - | - | - | - | 2 | - | 3 | 1 | 3 | 2 | - |
| **CO2** | 3 | 2 | 1 | 1 | - | - | - | - | 2 | - | 3 | 1 | 3 | 2 | - |
| **CO3** | 3 | 2 | 1 | 1 | - | - | - | - | 1 | - | 3 | 1 | 3 | - | - |
| **CO4** | 3 | 2 | 1 | 1 | - | - | - | - | 2 | - | 3 | 1 | 3 | 2 | - |
| **CO5** | 3 | 2 | 1 | 1 | - | - | - | - | 1 | - | 3 | 1 | 3 | 2 | - |
| **Average** | **3** | **2** | 1 | 1 | **-** | **-** | **-** | **-** | **2** | **-** | **3** | 1 | **3** | **2** | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours /Week** | | | **Credit** | **Maximum marks** | |
| **22AI15028** | **BIOMETRICS TECHNOLOGIES** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn the behavioral and physical biometric modalities.<br>• Knowledge of data acquisition techniques on mobile platforms.<br>• Abilities to build and evaluate a biometric system.<br>• Awareness of challenges in commercial systems.<br>• Learn a broad range of approaches to biometrics reflecting both fundamental principles and the current state-of-the-art practices. | | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Describe principles of the selected physical and behavioral biometric methods, and know how to deploy them in authentication scenarios.<br>• Organize and conduct biometric data collection processes, and understand how to use biometric databases in system evaluation.<br>• Calculate distributions of within- and between-class matching scores, and calculate various error estimates based on these distributions.<br>• Understand the biometrics security issues, and know how to deploy selected liveness detection techniques to make a system spoof-resistant.<br>• Deploy statistical methods in biometric system evaluation. | | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | | **9** |
| Introduction-Biometric Authentication-Biometric Technologies-Benefits of biometrics, Verification and identification: Basic working of biometric matching, Accuracy, False match rate, False non-match rate, Failure to enroll rate, Active and passive biometric, Parameters of a good biometrics. | | | | | | | |
| **UNIT-II** | **FINGER BIOMETRIC TECHNOLOGY** | | | | | | **9** |
| Fingerprint Sensors-Comparing Fingerprint Sensor Technologies-Fingerprint Extraction and Matching-Micro and Macro Features, Types of algorithms used for interpretation, Components and Operations: Strength and weakness. | | | | | | | |
| **UNIT-III** | **IRIS RECOGNITION** | | | | | | **9** |
| Eye and iris morphogenesis, genetic penetrance. Principles of iris image capture, iris sensors. Iris image preprocessing, segmentation, formatting and filtering. Daugman's method, iris code, statistical properties of the iris code. Other iris coding methods, wavelet analysis | | | | | | | |
| **UNIT-IV** | **FACE RECOGNITION** | | | | | | **9** |

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|---|---|---|
| Face detection in still images and sequences. Face features. Face space, principal component analysis and its application, Eigen faces, linear discriminant analysis and its application, Fisher faces. Face recognition methods. | | |
| **UNIT-V** | **MULTI BIOMETRICS AND BIOMETRIC SECURITY MODALS** | **9** |
| Basic concept of Multi-modal biometric Systems, Advantages of Multimodal over Unimodal Biometric Systems, Multimodal fusion techniques. Biometric Security Modals,-Various attack vectors and there remedial solutions, Template Security techniques. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS :** | |
| 1 | Jain, A.K., Ross, A., Nandakumar, K. Introduction to Biometrics. Edition 2011 |
| 2 | https://www.fingerprints.com/uploads/2019/10/fpc_white_paper_digital.pdf |
| **REFERENCES:** | |
| 1 | Marcel, S., Nixon, M.S., Li, S.Z., Handbook of Biometric Anti-Spoofing: Trusted Biometrics under Spoofing Attacks (Advances in Computer Vision and Pattern Recognition). Edition 2014 |
| 2 | Maltoni, D., Maio, D., Jain, A.K., Prabhakar, S., Handbook of Fingerprint Recognition. Second edition 2009 |
| 3 | Burge, M.J., Bowyer, K., Handbook of Iris Recognition. Edition 2013 |
| 4 | Biometrics: Concepts and Applications By G.R. Sinha, Sandeep Patil, Wiley,2011 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO4** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **Average** | **3** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **2** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**MAHENDRA ENGINEERING COLLEGE**
**(Autonomous)**

| Syllabus | | | | | | |
|---|---|---|---|---|---|---|
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours /week** | | | **Credit** | **Maximum marks** |
| **22AI15029** | **PREDICTIVE ANALYSIS** | **L** | **T** | **P** | **C** | **100** |
| | | 3 | 0 | 0 | 3 | |
| **Objective(s)** | **The student should be made to:**<br>• Gain the terminology, technology and applications of predictive analysis<br>• Learn the data preparation techniques and generate appropriate association rules<br>• Gain various descriptive models, their merits, demerits and application.<br>• Learn various predictive modeling methods.<br>• Familiarize the text mining tools, technologies and case study which is used in day-today analytics cycle | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to**<br>• Explain terminology, technology and applications of predictive analysis<br>• Apply data preparation techniques to effectively interpret big data<br>• Discuss various descriptive models, their merits, demerits and application.<br>• Describe principles of predictive analytics and apply them to achieve real, pragmatic solutions.<br>• Illustrate the features and applications of text mining. | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | **9** |
| Introduction to predictive analytics – Business analytics: types, applications- Models: predictive models – descriptive models – decision models - applications - analytical techniques | | | | | | |
| **UNIT-II** | **DATA UNDERSTANDING PREPARATION** | | | | | **9** |
| Data Understanding: Single Variable Summaries – Data Visualization in One Dimension – Histograms – Multiple Variable Summaries – Data Visualization Data Preparation: Variable Cleaning – Feature Creation | | | | | | |
| **UNIT-III** | **DESCRIPTIVE MODELLING** | | | | | **9** |
| Descriptive Modeling- Data Preparation Issues with Descriptive Modeling- Principal Component Analysis- Clustering Algorithms- Interpreting Descriptive Models- Standard Cluster Model Interpretation | | | | | | |
| **UNIT-IV** | **PREDICTIVE MODELLING** | | | | | **9** |
| Decision Trees- Logistic Regression -Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models - Linear Regression - Other Regression Algorithms | | | | | | |
| **UNIT-V** | **TEXT MINING** | | | | | **9** |
| Motivation for Text Mining- A Predictive Modeling Approach to Text Mining- Structured vs. Unstructured Data- Why Text Mining Is Hard- Data Preparation Steps- Text Mining Features- Modeling with Text Mining Features- Regular Expressions- Case Studies:- Survey Analysis. | | | | | | |
| | **TOTAL HOURS** | | | | | **45** |

**TEXT BOOKS :**

| | |
|---|---|
| 1 | Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014 |
| 2 | Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012. |
| 3 | Jeffrey Strickland, Predictive analytics using R, Simulation educators, ColoradoSprings, 2015 |
| 4 | Max Kuhn and Kjell Johnson, Applied Predictive Modeling, 1st editionSpringer, 2013 |
| **REFERENCES:** | |
| 1 | Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012. |
| 2 | Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani. An Introduction to Statistical Learning with Applications in R Springer 2013 |
| 3 | Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014 |
| 4 | Anasse Bari, Mohammad Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, 2017. |


**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 2 | 3 | 2 | - |
| **CO2** | 2 | 1 | - | - | - | - | - | - | - | 1 | 3 | 3 | 1 | 1 | - |
| **CO3** | 3 | 1 | 1 | - | - | - | - | - | 1 | 1 | 2 | 2 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | 2 | 2 | 3 | 3 | 2 | 3 | - |
| **CO5** | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 2 | 3 | 2 | 2 | - |
| **Average** | **2.6** | **1.4** | **1** | **-** | **-** | **-** | **-** | **-** | **1.4** | **1.2** | **2.6** | **2.6** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | | **C** | |
| **22AI15030** | **PATTERN RECOGNITION** | 3 | 0 | 0 | | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Provide basic knowledge about the fundamentals of pattern recognition and its applications.<br>• Learn about unsupervised algorithms suitable for pattern classification.<br>• Familiarize with the feature selection algorithms and methods of implementing them in applications<br>• Learn about the basis of algorithms used for training and testing the dataset.<br>• Learn basic fuzzy system and neural network architectures, for applications in pattern recognition, image processing, and computer vision | | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to :**<br>• Implement basic pattern classifier algorithms<br>• Have knowledge about the working principle of unsupervised algorithms.<br>• Have knowledge about functionality of classifiers..<br>• Perceive the recent advancement in pattern recognition.<br>• Apply SVM and HMM algorithms for real time applications.<br>• Implement advanced methodologies over image processing application. | | | | | | |
| **UNIT-I** | **PATTERN CLASSIFIER** | | | | | | **9** |
| Overview of Pattern Recognition – Discriminant Functions – Parametric Estimation – Alternative Classification Procedures-Measurement of Classification Performance-Maximum Likelihood Estimation – Bayes Theorem – Bayesian Belief Network, , Naive Bayesian Classifier. | | | | | | | |
| **UNIT-II** | **CLUSTERING & GRAPHICAL APPROACH** | | | | | | **9** |
| Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – EM Algorithm – Grid Based Clustering – Density Based Clustering- Graph Based Structural Representation, Graph Isomorphism, A Structured Strategy to Compare Attribute Graphs | | | | | | | |
| **UNIT-III** | **FEATURE EXTRACTION & GRAMATICAL INFERENCE IN SYNTATIC PATTERN RECOGNITION** | | | | | | **9** |
| Entropy Minimization – Karhunen Loeve Transformation –Learning Grammars, Problem formulation, Grammatical Inference (GI) Approaches, Procedures to Generate Constrained Grammars. | | | | | | | |
| **UNIT-IV** | **HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINES** | | | | | | **9** |
| State Machines – Hidden Markov Models: Maximum Likelihood for the HMM, The Forward and Backward Algorithm, Sum-Product Algorithm for the HMM, Scaling Factors, The Viterbi Algorithm, Extensions Of The Hidden Markov Model – Hidden Markov Model in NLP-Support Vector | | | | | | | |

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| Machines: Maximum Margin Classifiers, Relevance Vector Machines | | |
| **UNIT-V** | **RECENT ADVANCES** | **9** |
| Fuzzy Classification: Fuzzy Set Theory, Fuzzy And Crisp Classification, Fuzzy Clustering, Fuzzy Pattern Recognition – Introduction to Neural Networks: Physical neural network-The Artificial Neural network model-Neural pattern Associators and Matrix approaches, Hebbnet, Perceptron, ADALINE, Back Propagation | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Andrew Webb, "Statistical Pattern Recognition", Arnold publishers, London, 1999 |
| 2 | M. Narasimha Murthy, V. Susheela Devi, "Pattern Recognition", Springer 2011. |
| **REFERENCES:** | |
| 1 | C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006. |
| 2 | R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", John Wiley,ISBN |
| 3 | Menahem Friedman, Abraham Kandel, "Introduction to Pattern Recognition Statistical, Structural, Neural and Fuzzy Logic Approaches", World Scientific publishing Co. Ltd, 2000. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 1 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO4** | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO5** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **Average** | **3** | 2 | **1.4** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **2.6** | **1.6** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**MAHENDRA ENGINEERING COLLEGE**

| (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** | |
| **22AI15031** | **SOCIAL MEDIA ANALYSIS** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Gain knowledge about the theoretical structure of social network data sources.<br>• Understand the ethics in media and its emerging technology.<br>• Familiar with the concept of filtering technique in recommender systems.<br>• Have to know about social structurally with the variety of business intelligence applications.<br>• Understand human behavior in social Media and related communities. | | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to**:<br>• Elaborate the structure of social network data sources.<br>• Interpret the role of social media strategy in various fields.<br>• Apply the concept of filtering technique in recommender systems.<br>• Use extraction and mining tools for analyzing Social networks.<br>• Illustrate the functionality of social media in public sector. | | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | | 9 |
| Analyzing the social web- history of the social web- online Social networks, Basics Network Structure and Properties - Defining Trust - Measuring trust - Network-based inference - Trust in social media – Defining nodes and edges. | | | | | | | |
| **UNIT-II** | **MEDIA AND EMERGING TECHNOLOGY** | | | | | | 9 |
| Introduction to Social Media - Law & Ethics in Social Media - Building a Social Media Strategy - Social Monitoring, Listening and Analysis - Social Media Platforms & Best Practices - Creating Engaging Content - Writing for Social Media - Social Media Crises & Tragedies - Social Media & Emerging Technology. | | | | | | | |
| **UNIT-III** | **FILTERING AND MINING COMMUNITIES** | | | | | | 9 |
| Social Sharing and Filtering - Social recommender systems - Collaborative Filtering on LinkedIn and Netflix - Aggregating and reasoning with social network data, Detecting Communities in Social Networks, Core Methods for Community Detection & Mining, Applications of Community Mining Algorithms. | | | | | | | |
| **UNIT-IV** | **PUBLIC SECTOR** | | | | | | 9 |
| Analyzing Public- Sector Social Media – Privacy: Privacy policies and settings - Aggregation and data mining - Data ownership and maintaining privacy online - privacy in social media analysis - Case study: Congressional use of twitter. | | | | | | | |
| **UNIT-V** | **CASE STUDY** | | | | | | 9 |

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|---|---|
| The Enron email network, Trust-based movie recommendations, Movie Recommendation System like LinkedIn, Sentiment Analysis: Twitter, YouTube and Movie Reviews, Reasoning with social media, Spam in social media, Rumors and deception in social media | |
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS:** | |
| 1 | Analyzing the Social Web 1st Edition, Kindle Edition by Jennifer Golbeck |
| 2 | Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 2010 |
| **REFERENCES:** | |
| 1 | A Handbook of Statistical Analyses using SPSS, Sabine Landau and Brian S. Everitt |
| 2 | Roger DWimmer &Joseph R. Dominick, Mass Media Research- An Introduction, Wads worth, New York, 1991 |
| 3 | Guandong Xu , Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, Springer, 1st edition, 2012 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | 1 | 1 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | 3 | 3 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | 2 | - | 3 | 3 | 2 | 3 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | 2 | - | 3 | 3 | 2 | 2 | - |
| **Average** | **3** | 2 | **2** | **-** | **-** | **-** | **-** | **-** | **2** | **-** | **3** | **3** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
| **22AI15032** | **OPTIMIZATION TECHNIQUES** | **L** | **T** | **P** | **C** | **100** |
| | | 3 | 0 | 0 | 3 | |
| **Objective(s)** | **The student should be made to:**<br>• Operation research models using optimization techniques based upon the fundamentals of engineering mathematics (minimization and Maximization of objective function).<br>• The problem formulation by using linear, dynamic programming, game theory and queuing models.<br>• The problem formulation by using non-linear programming model to solve the constrained optimization problems<br>• The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.<br>• Formulation of mathematical models for quantitative analysis of managerial problems in industry. | | | | | |
| **Outcome(s)** | **On completion of the course, the students will be able to:**<br>• Investigate the optimization problem and the classical optimization techniques<br>• Apply the linear programming model as a solution to various problems with linear functions<br>• Make use of non-linear programming model to solve the constrained optimization problems<br>• Develop optimal solutions for multistage decision problems using dynamic programming<br>• Apply modern optimization techniques to solve decision problems | | | | | |
| **UNIT-I** | **OPTIMIZATION PROBLEM** | | | | | **9** |
| Statement Of An Optimization Problem: Design Vector – Design Constraints – Constraint Surface – Objective Function – Classification Of Optimization Problems Classification Based On The Existence Of Constraints – Nature Of The Design Variables – Physical Structure Of The Problem – Nature Of The Equations Involved – Classical Optimization Techniques. | | | | | | |
| **UNIT-II** | **LINEAR PROGRAMMING** | | | | | **9** |
| Standard Form Of A Linear Programming Problem – Geometry Of Linear Programming Problems – Definitions And Theorems – Solution Of A System Of Linear Simultaneous Equations – Pivotal Reduction Of A General System Of Equations. | | | | | | |
| **UNIT-III** | **NONLINEAR PROGRAMMING** | | | | | **9** |

| | | |
|---|---|---|
| Constrained Optimization Techniques – Random Search Methods – Complex Method – Sequential Linear Programming – Transformation Techniques – Basic Approach Of The Penalty Function Method – Interior Penalty Function Method – Convex Programming Problem – Exterior Penalty Function Method – Extrapolation Techniques In The Interior Penalty Function Method – Extended Interior Penalty Function Methods. | | |
| **UNIT-IV** | **DYNAMIC PROGRAMMING** | **9** |
| Multistage Decision Processes – Types Of Multistage Decision Problems – Concept Of Sub Optimization And Principle Of Optimality – Computational Procedure In Dynamic Programming – Illustrating The Calculus Method Of Solution – Illustrating The Tabular Method Of Solution . | | |
| **UNIT-V** | **MODERN METHODS OF OPTIMIZATION** | **9** |
| Genetic Algorithms – Simulated Annealing – Particle Swarm Optimization – Solution Of The Constrained Optimization Problem – Ant Colony Optimization – Optimization Of Fuzzy Systems Neural-Network-Based Optimization – Metaheuristic Optimization Methods – Multilevel And Multi Objective Optimization. | | |
| | **TOTAL HOURS** | **45** |

| **TEXTBOOKS** | |
|---|---|
| 1 | Singiresu S. Rao, "Engineering Optimization: Theory and Practice", John Wiley and Sons, 5th edition, 2019 (Units 1-5) |
| 2 | George Bernard Dantzig, MukundNarain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003. |
| **REFERENCES** | |
| 1 | H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007 |
| 2 | Rao S.S,"Optimization – Theory and applications", Wiley Easter Ltd., 1979. |
| 3 | David G.Luerbeggan, "Introduction to Linear and Non Linear Programming", Addison Wesley Publishing Co. 1973.. |
| 4 | Cordan C.C. Beveridge and Robert S. Schedther, "Optimization, Theory and Practice" McGraw Hill Co.1970. |
| 5 | Hadley G. "Nonlinear and – dynamic programming" Addison Wesley Publishing Co. 1964 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 2 | 3 | 2 | - |
| **CO2** | 2 | 1 | - | - | - | - | - | - | - | 1 | 3 | 3 | 1 | 1 | - |
| **CO3** | 3 | 1 | 1 | - | - | - | - | - | 1 | 1 | 2 | 2 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | 2 | 2 | 3 | 3 | 2 | 3 | - |
| **CO5** | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 2 | 3 | 2 | 2 | - |
| **Average** | **2.6** | **1.4** | **1** | **-** | **-** | **-** | **-** | **-** | **1.4** | **1.2** | **2.6** | **2.6** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours /week** | | | **Credit** | **Maximum Marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15033** | **SOFT COMPUTING** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Acquire knowledge of soft computing theories fundamentals<br>• Learn the fundamentals of non-traditional technologies and approaches to solving hard real-world problems.<br>• Learn and apply artificial neural networks, fuzzy sets and fuzzy logic, and genetic algorithms in problem solving and use of heuristics based on human experience<br>• Gain the ideas of fuzzy sets, fuzzy logic. To become familiar with neural<br>• Familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations. | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to:**<br>• Awake the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.<br>• Acquire knowledge of soft computing theories fundamentals and so they will be able to design program systems using approaches of these theories for solving various real world problems.<br>• Try and integrate the knowledge of neural networks, fuzzy logic, genetic algorithms, probabilistic reasoning, rough sets, chaos, hybrid approaches<br>• Apply suitable soft computing techniques for various applications.<br>• Integrate various soft computing techniques for complex problems. | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | **9** |
| Introduction- Artificial Intelligence - Artificial Neural Networks - biological neurons - Basic models of artificial neural networks - Fuzzy Systems - Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems - Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network- Madaline Network. | | | | | | |
| **UNIT-II** | **ARTIFICIAL NEURAL NETWORKS** | | | | | **9** |
| Fundamental of neural networks - Characteristic of Neural networks - Back propagation Neural Networks – Kohonen Neural Network -Learning Vector Quantization - Hamming Neural Network – Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks. | | | | | | |
| **UNIT-III** | **FUZZY SYSTEMS** | | | | | **9** |
| Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets – Classical Relations and Fuzzy Relations -Fuzzy sets -Defuzzification – Applications | | | | | | |

| UNIT-IV | GENETIC ALGORITHMS | 9 |
|---|---|---|
| Fundamental of genetic algorithms - Basic Concepts- Working Principles -Encoding- Fitness Function – Reproduction -Inheritance - Operators – Cross Over – Inversion and Deletion -Mutation Operator – Bit-wise Operators - Generation cycle - Convergence of Genetic Algorithm | | |
| **UNIT-V** | **HYBRID SYSTEMS** | **9** |
| Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination –Application-LR Type Fuzzy Numbers – Fuzzy Neuron – Fuzzy BP Architecture – Learning in Fuzzy BP- Inference by Fuzzy BP – Fuzzy Associative memories. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS** | |
|---|---|
| 1 | N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University |
| 2 | S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic |
| **REFERENCES** | |
| 1 | James A. Freeman and David M. Skapura, ―Neural Networks Algorithms, Applications, and Programming Techniques, Addison Wesley, 2003. |
| 2 | Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, ―Neuro-Fuzzy and Soft Computing, |
| 3 | Kwang H.Lee, ―First course on Fuzzy Theory and Applications, Springer, 2005. |
| 4 | George J. Klir and Bo Yuan, ―Fuzzy Sets and Fuzzy Logic-Theory and Applications, |
| 5 | James A. Freeman and David M. Skapura, ―Neural Networks Algorithms, Applications, and |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 2 | 2 | - | - | - | - | - | - | - | 2 | 3 | 1 | 2 | - |
| **CO4** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 2 | 2 | 1 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **Average** | **3** | **2** | **1.2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2.8** | **2.8** | **1.6** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | | | | **Programme Code** | **1161** |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/Week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15034** | **INTRODUCTION TO CYBER SECURITY** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Learn the basics of Cyber Security Standards and Policies.<br>• Know the legal, ethical and professional issues in Cyber security.<br>• Learn Cyber Frauds and Abuse and its Security Measures.<br>• Know the technological aspects of Cyber Security.<br>• Learn security policies in cyber forensics. | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to:**<br>• Identify basics of computer forensics.<br>• Outline the strategies adopted in computer forensics.<br>• Outline the occurrence of Cybercrime in mobile and wireless environment.<br>• Use relevant tools and methods in cybercrime.<br>• Apply security policies in cyber forensics. | | | | | |
| **UNIT-I** | **FUNDAMENTALS OF CYBER SECURITY** | | | | | **9** |
| Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime– A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment. | | | | | | |
| **UNIT-II** | **CYBERCRIME AND CYBEROFFENSES** | | | | | **9** |
| Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Email Spoofing – Spamming – Cyber defamation – Internet Time Theft – Forgery – Web jacking – Hacking – Online Frauds – Software Piracy – Mail Bombs – Password Sniffing – Cyberoffenses – Categories – Planning the attacks – Cyber stalking – Cybercafé and Cybercrimes – Botnets. | | | | | | |
| **UNIT-III** | **CYBERCRIME: MOBILE AND WIRELESS DEVICES** | | | | | **9** |
| Proliferation of Mobile and Wireless Devices – Trends in Mobility – Credit card frauds in Mobile and Wireless Computing – Security Challenges – Authentication Service Security – Attacks on Mobile Phones. | | | | | | |
| **UNIT-IV** | **TOOLS AND METHODS USED IN CYBERCRIME** | | | | | **9** |
| Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Spywares – Virus and Worms – Trojan Horses and Backdoors – Steganography – DoS and DDoS Attacks. | | | | | | |
| **UNIT-V** | **SECURITY POLICIES** | | | | | **9** |
| Introduction - Defining User Policies – Passwords – Internet Use – Email Usage – Installing/ Uninstalling Software – Instant Messaging – Defining System Administrative Policies – Defining | | | | | | |

| | |
|---|---|
| Access Control Developmental Policies Standards, Guidelines and Procedures – Basics of assessing a system | |
| **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOKS :** | |
| | Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021 (Unit 1) |
| 1 | Nina Godbole, SunitBelapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley, 2011. |
| 2 | Chuck Easttom, "Computer Security Fundamentals", 2nd Edition, Pearson Education, 2012. |
| **REFERENCES:** | |
| 1 | John R.Vacca,Computer Forensics, Cengage Learning, 2005. |
| 2 | Richard E.Smith, Internet Cryptography, 3rd Edition Pearson Education, 2008. |
| 3 | MarjieT.Britz, Computer Forensics and Cyber Crime: An Introduction, 3rd Edition, Prentice Hall, 2013. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 2 | 3 | 2 | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | 1 | 2 | 1 | 1 | 2 | - |
| **CO3** | 3 | 1 | 1 | - | - | - | - | - | 1 | 1 | 2 | 2 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | 2 | 2 | 3 | 1 | 2 | 1 | - |
| **CO5** | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | 1 | 2 | 2 | 2 | - |
| **Average** | **3** | **1.8** | **1.2** | **-** | **-** | **-** | **-** | **-** | **1.4** | **1.2** | **2.2** | **1.6** | **2** | **1.8** | - |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | | **Programme Code** | | | **1161** | |
| **Artificial Intelligence & Data Science** | | | | | | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | | **Credit** | **Maximum marks** |
| **22AI15035** | **CRYPTOGRAPHY AND NETWORK SECURITY** | **L** | **T** | **P** | | **C** | **100** |
| | | 3 | 0 | 0 | | 3 | |
| **Objective(s)** | **The student should be made to:**<br>• To understand the fundamentals of cryptography and number theory.<br>• To use the standard security algorithms to provide confidentiality, integrity andauthentication for any applications.<br>• To make use of application protocols to design and manage a secure system.<br>• To learn the configuration and manage Firewall and WLAN Security.<br>• To understand the importance of system security and its vulnerabilities. | | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to:**<br>• Apply the basic security algorithms and policies required for a computing system.<br>• Predict the vulnerabilities across any computing system and hence be able to design security solution for any computing system.<br>• To identify any network security issues and resolves the issues.<br>• To manage the firewall and WLAN security.<br>• Evaluate the system related vulnerabilities and mitigation.<br>• To design secured web applications in real-time. | | | | | | |
| **UNIT-I** | **INTRODUCTION TO SECURITY AND NUMBER THEORY** | | | | | | 9 |
| Basics of Security – CIA Triad – Threats, Attacks and Services – Classical Cryptography – Substitution – Transposition – One-time Pad – Cryptanalysis – Number Theory – ModularArithmetic – Euclidean Theorem – Extended Euclidean Theorem – Algebraic Structures –Galois Field – Prime Numbers – Fermat's Theorem – Euler's Phi function – Euler's Theorem– Chinese Remainder theorem – Modular Exponentiation –Logarithms – Elliptic Curve Arithmetic. | | | | | | | |
| **UNIT-II** | **SYMMETRIC CRYPTOGRAPHY** | | | | | | 9 |
| Modern Cryptography – Symmetric Cipher – Block and Stream Cipher – Feistel Ciphers –Data Encryption Standard (DES) – DES Structure – Key Generation – Simplified DES –Linear and Differential cryptanalysis –Triple DES – Advanced Encryption Standard (AES) –Basic Structure – Transformations – Key Expansions Process – Analysis of AES – Modes of operation – RC4. | | | | | | | |
| **UNIT-III** | **ASYMMETRIC KEY CRYPTOGRAPHY** | | | | | | 9 |
| Public Key Cryptosystems – RSA Algorithm – ElGamal Cryptosystems – Diffie-Hellman key exchange – Elliptic curve cryptography – Hash functions – Hash algorithms – Secure Hash Algorithm SHA – MD5 – Message Authentication Codes – Quantum Cryptography –Quantum Key Distribution – Threshold Cryptography. | | | | | | | |

| UNIT-IV | SECURITY APPLICATIONS | 9 |
|---|---|---|
| Digital Signatures Schemes– Digital Certificate – Key Management – Kerberos – KeyAgreement and Distribution – PKI – X.509 Certificate – E-Mail Security – PGP – S/MIME –IP security – Virtual Private Network (VPN) – Web Security – Secure Socket Layer (SSL) –Transport Layer Security – Secure Electronic Transaction (SET) – Blockchain. | | |
| **UNIT-V** | **FIREWALL & WIRELESS SECURITY** | 9 |
| Buffer Overflow and Malicious Software – Password Management – Introduction to Firewall– Firewall Generations – Intrusion Detection System – Types of IDS – Intrusion Prevention System – Wireless LAN – Wireless LAN Security – Network Access Control and Cloud Security. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS:** | |
|---|---|
| 1 | William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI, Seventh Edition, 2017. |
| 2 | Behourz Forouzan, DebdeepMukhopadyay, "Cryptography and Network Security", Tata McGraw Hill Education Pvt. Ltd, New Delhi, 2010. |
| **REFERENCES:** | |
| 1 | Wenbo Mao, "Modern Cryptography Theory and Practice", Pearson Education, 2004. |
| 2 | Pfleeger and Pfleeger, "Security in computing", Third Edition , PHI/Pearson, 2003. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 1 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 3 | 2 | - |
| **CO4** | 3 | 2 | 1 | - | - | - | - | - | - | - | 3 | 3 | 3 | 1 | - |
| **CO5** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 | 1 | - |
| **Average** | **3** | **2** | **1.4** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **3** | **3** | **3** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

**MAHENDRA ENGINEERING COLLEGE**
**(Autonomous)**

**Syllabus**

| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | **1161** |
|---|---|---|---|

**Program Elective**

| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **C** | |
| **22AI15036** | **INFORMATION RETRIEVAL TECHNIQUES** | 3 | 0 | 0 | 3 | **100** |

| | |
|---|---|
| **Objective(s)** | **The student should be made to:**<br>• Discusses the basics of information retrieval<br>• Search engine operations<br>• Multimedia information retrieval techniques<br>• Learn about web information retrieval and web crawling<br>• Discusses about audio, music and video information retrieval techniques |
| **Outcome(s)** | **Upon completion of this course , students will be able to:**<br>• Describe the basic concepts of information retrieval<br>• Apply the various modeling techniques<br>• Discuss the concepts of text operations, indexing and searching<br>• Describe about web information retrieval and web crawling<br>• Explore audio, music and video information retrieval techniques |

| **UNIT-I** | **INFORMATION RETRIEVAL TECHNIQUES** | 9 |
|---|---|---|

Information Retrieval - The IR Problem - The users task - Information versus data retrieval - The IR System - Software architecture of IR system - Retrieval and ranking processes - The web - Web changed search - Practical issues on the web - How people search - Search interfaces today - Visualization in Search Interfaces.

| **UNIT-II** | **MODELING AND RETRIEVAL EVALUATION** | 9 |
|---|---|---|

Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation.

| **UNIT-III** | **TEXT OPERATIONS, INDEXING AND SEARCHING** | 9 |
|---|---|---|

Text Properties - Document Preprocessing - Text Compression – Text Classification – Characterization of Text Classification – Unsupervised Algorithms – Supervised Algorithms – Decision Tree – K-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation Metrics – Accuracy and Error – Indexing and Searching – Inverted Indexes – Sequential Searching – Multidimensional Indexing.

| **UNIT-IV** | **WEB RETRIEVAL AND WEB CRAWLING** | 9 |
|---|---|---|

The Web – Search Engine Architectures – Cluster Based Architecture – Distributed Architectures – Search Engine Ranking – User Interaction –Browsing – Web Crawling – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

| UNIT-V | MULTIMEDIA INFORMATION RETRIEVAL | 9 |
|---|---|---|
| Content-based image retrieval – Audio and music retrieval – Retrieving and browsing video – Fusion models – Segmentation – Compression and MPEG standards –Case study. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS:** | |
|---|---|
| 1. | Ricardo Baeza-Yate, BerthierRibeiro-Neto, "Modern Information Retrieval", 2nd Edition, Pearson Education Asia, 2011. |
| **REFERENCES:** | |
| 1. | Chowdhury G.G., "Introduction to Modern Information Retrieval", 2nd Edition, Neal-schuman Publishers, 2003. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | 2 | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 1 | 2 | - | - | - | - | - | 1 | 1 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | 3 | 3 | 2 | 2 | - |
| **CO4** | 2 | 2 | 2 | | - | - | - | - | 2 | 2 | 2 | 3 | 2 | 3 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | 1 | - | 3 | 3 | 2 | 2 | - |
| **Average** | **2.8** | **1.8** | **1.4** | **-** | **-** | **-** | **-** | **-** | **1.4** | **1.2** | **2.8** | **3** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** | |
| **22AI15037** | **CYBER FORENSICS** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn computer forensics<br>• Become familiar with forensics tools<br>• Learn to analyze and validate forensics data<br>• Gain the ethical hacking and Sniffing<br>• Familiarize about ethical hacking in web | | | | | | |
| **Outcome(s)** | **Upon completion of this course, students will be able to :**<br>• Summarize the basic concepts of Computer forensics & its principles.<br>• Learn the basics of forensics tools<br>• Analyze and validate forensic data.<br>• Learn the ethical hacking and sniffing concepts.<br>• Apply the ethical hacking principles in hacking mobile platforms | | | | | | |
| **UNIT-I** | **INTRODUCTION TO COMPUTER FORENSICS** | | | | | | 9 |
| Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation - Data Acquisition. | | | | | | | |
| **UNIT-II** | **EVIDENCE COLLECTION AND FORENSICS TOOLS** | | | | | | 9 |
| Processing Crime and Incident Scenes - Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools. | | | | | | | |
| **UNIT-III** | **ANALYSIS AND VALIDATION** | | | | | | 9 |
| Validating Forensics Data - Data Hiding Techniques Performing Remote Acquisition Network Forensics - Email Investigations - Cell Phone and Mobile Devices Forensics | | | | | | | |
| **UNIT-IV** | **ETHICAL HACKING** | | | | | | 9 |
| Introduction to Ethical Hacking – Foot printing and Reconnaissance - Scanning Networks Enumeration - System Hacking - Malware Threats - Sniffing | | | | | | | |
| **UNIT-V** | **ETHICAL HACKING IN WEB** | | | | | | 9 |
| Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications - SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms | | | | | | | |
| | | | | | | **TOTAL HOURS** | **45** |

| TEXT BOOKS: | |
|---|---|
| 1 | Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, ―ComputerForensics and Investigations, Cengage Learning, India Edition, 2016. |
| 2 | CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015. |
| **REFERENCES:** | |
| 1 | MarjieT.Britz, ―Computer Forensics and Cyber Crime: An Introduction, 3rd Edition,Prentice Hall, 2013. |
| 2 | AnkitFadia ― Ethical Hacking Second Edition, Macmillan India Ltd, 2006 |
| 3 | Kenneth C.Brancik ―Insider Computer Fraud‖ Auerbach Publications Taylor &Francis Group–200 |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | - | 3 | 2 | 3 | 2 | - |
| **CO2** | 3 | 2 | - | - | - | - | - | - | - | 1 | 3 | 1 | 1 | 2 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | 2 | 2 | 2 | 2 | - |
| **CO4** | 3 | 2 | 2 | | - | - | - | - | 2 | 2 | 3 | 1 | 2 | 1 | - |
| **CO5** | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | 2 | 3 | 2 | 2 | - |
| **Average** | **3** | **2** | **1.2** | **-** | **-** | **-** | **-** | **-** | **1.4** | **1.2** | **2.6** | **1.8** | **2** | **1.8** | **-** |

**1 - Low, 2 - Medium, 3 - High, ‘-“- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** | |
| **22AI15038** | **FUNDAMENTALS OF NANO SCIENCE** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn about basis of nano material science and properties.<br>• Have knowledge about an aware of general preparation methods.<br>• Familiarize with the working environment of nano materials.<br>• Understand the concepts of characterization techniques.<br>• Gain expertisein nanotechnology and applications. | | | | | | |
| **Outcome(s)** | **Upon completion of this course, students will be able to :**<br>• Distinguish Explain about the science of nano materials.<br>• Demonstrate the preparation of nano materials.<br>• Interpret the concepts of preparation environment of nano science.<br>• Design characteristic nano material.<br>• Analyze the nano science as social applications. | | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | | 9 |
| Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nano structured materials- nano particles- quantum dots, nanowires-ultra-thin films-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only). | | | | | | | |
| **UNIT-II** | **GENERAL METHODS OF PREPARATION** | | | | | | 9 |
| Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE. | | | | | | | |
| **UNIT-III** | **PREPARATION ENVIRONMENTS** | | | | | | 9 |
| Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards. | | | | | | | |
| **UNIT-IV** | **CHARACTERIZATION TECHNIQUES** | | | | | | 9 |
| X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation. | | | | | | | |

| UNIT-V | APPLICATIONS | 9 |
|---|---|---|
| Nano InfoTech: Information storage- nano computer, molecular switch, super chip, nano crystal, Nano biotechlogy: nano probes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bio imaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nano particles for sunbarrier products-InPhotostat ,printing,solarcell,battery. | | |
| | **TOTAL HOURS** | **45** |

| **TEXT BOOKS:** | |
|---|---|
| 1 | A.S. Edelstein and R.C. Cammearata, eds., ―Nano materials: Synthesis, Properties and Applications, Institute of Physics Publishing, Bristol and Philadelphia, 1996. |
| 2 | N John Dinardo, ―Nanoscale Charecterisation of surfaces & Interfaces,2nd edition, Weinheim Cambridge, Wiley-VCH, 2000. |
| **REFERENCES:** | |
| 1 | G Timp, ―Nanotechnology, AIP press/Springer, 1999. |
| 2 | Akhlesh Lakhtakia,The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations. Prentice-Hall of India (P) Ltd, New Delhi, 2007. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 3 | 2 | 2 | - |
| **CO2** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO3** | 3 | 1 | - | - | - | - | - | - | - | - | 2 | 3 | 1 | 2 | - |
| **CO4** | 3 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 2 | 1 | - |
| **CO5** | 3 | 1 | 2 | - | - | - | - | - | - | - | 3 | 3 | 1 | 1 | - |
| **Average** | **3** | **1.6** | **1.2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2.8** | **3** | **1.6** | **1.4** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRA ENGINEERING COLLEGE (Autonomous) | | | | | | |
|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | | | | **Programme Code** | **1161** |
| **Program Elective** | | | | | | |
| **Course code** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum marks** |
| | | **L** | **T** | **P** | **C** | |
| **22AI15039** | **TOTAL QUALITY MANAGEMENT** | 3 | 0 | 0 | 3 | **100** |
| **Objective(s)** | **The student should be made to:**<br>• Facilitate the understanding of Quality Management principles and process<br>• Learn TQM principles<br>• Learn tools and techniques for TQM<br>• Gain the Advanced tools and techniques for TQM<br>• Gain the knowledge about Quality systems | | | | | |
| **Outcome(s)** | **Upon completion of this course , students will be able to**<br>• Understanding of Quality Management principles and process<br>• Describe Continuous improvement of an organization<br>• Demonstrate tools and techniques for TQM<br>• Design framework to evaluate the performance excellence of an organization<br>• Illustrate the Quality systems. | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | 9 |
| Definition of Quality - Dimensions of Quality - Quality Planning - Quality costs - Analysis Techniques for Quality Cost – Concepts, Role of Senior Management - Quality Council - Quality Statements - Strategic Planning - Deming Philosophy - Barriers to TQM Implementation. | | | | | | |
| **UNIT-II** | **TQM PRINCIPLES** | | | | | 9 |
| Customer satisfaction –Motivation - Empowerment - Teams - Recognition and Reward - Performance Appraisal - Benefits - Continuous Process Improvement – Juran Trilogy - Relationship Development - Performance Measures – Basic Concepts – Strategy - Performance Measure. | | | | | | |
| **UNIT-III** | **STATISTICAL PROCESS CONTROL (SPC)** | | | | | 9 |
| The seven tools of quality - Statistical Fundamentals – Measures of central Tendency and Dispersion - Population and Sample - Normal Curve - Control Charts for variables and attributes - Process capability - Concept of six sigma - New seven Management tools. | | | | | | |
| **UNIT-IV** | **TQM TOOLS** | | | | | 9 |

| | | |
|---|---|---|
| Benchmarking – Reasons to Benchmark - Benchmarking Process - Quality Function Deployment (QFD) –Concept - Improvement Needs - FMEA – Stages of FMEA. | | |
| **UNIT-V** | **QUALITY SYSTEMS** | 9 |
| Need for ISO 9000 and Other Quality Systems - ISO 9000:2000 Quality System – Elements - Implementation of Quality System – Documentation - Quality Auditing – QS. | | |
| | **TOTAL HOURS** | **45** |

| | |
|---|---|
| **TEXT BOOK:** | |
| 1 | Dale H.Besterfiled, et al., Total Quality Management, Pearson Education, Inc. 2003. (Indian reprint 2004). ISBN 81-297-0260-6. |
| **REFERENCE:** | |
| 1 | James R.Evans & William M.Lidsay, The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5). |
| **E-REFERENCES:** | |
| 1. | http://rmkec.ac.in/tmp/mech/Contents/totalqualitymanagement.pdf |
| 2. | https://drive.google.com/file/d/1vRO5gXOXC36Fhc5Er9cuYAF07S5N-jh9/view |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 2 | 1 | - | - | - | - | 2 | 2 | 3 | 2 | 3 | 3 | - |
| **CO2** | 1 | 2 | 1 | 1 | - | - | - | - | 2 | 1 | 3 | 2 | 3 | 3 | - |
| **CO3** | 2 | 1 | 2 | 2 | - | - | - | - | 2 | 1 | 3 | 3 | 2 | 2 | - |
| **CO4** | 2 | 1 | 1 | 1 | - | - | - | - | 1 | 2 | **3** | **2** | 2 | 2 | - |
| **CO5** | 2 | 1 | 1 | 1 | - | - | - | - | 2 | 2 | 3 | 2 | 3 | 3 | - |
| **Average** | **1.8** | **1** | **1** | **1** | **-** | **-** | **-** | **-** | **1.8** | **1.6** | 3 | 2 | **2.6** | **2.6** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**

| MAHENDRAENGINEERINGCOLLEGE (Autonomous) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Syllabus** | | | | | | | |
| **Department** | **Artificial Intelligence & Data Science** | **Programme Code** | | | **1161** | | |
| **Program Elective** | | | | | | | |
| **Program Elective** | **Course Name** | **Hours/week** | | | **Credit** | **Maximum Marks** | |
| **22AI15040** | **SWARM INTELLIGENCE** | **L** | **T** | **P** | **C** | **100** | |
| | | 3 | 0 | 0 | 3 | | |
| **Objective(s)** | **The student should be made to:**<br>• Learn the various characteristics of intelligent agents.<br>• Familiarize the different search strategies in ACO.<br>• Learn to represent knowledge in solving Swarm Optimization.<br>• Gain the different ways of designing software agents.<br>• Know about the various Herd Optimization Algorithms. | | | | | | |
| **Outcome(s)** | **Upon completion of the course, students will be able to**<br>• Use appropriate search algorithms for any AI Problem<br>• Represent a problem using ACO Algorithm for feature selection.<br>• Provide the apt agent strategy to solve a given problem.<br>• Design software agents to solve a problem.<br>• Design applications for Herd Optimization that use Artificial Intelligence. | | | | | | |
| **UNIT-I** | **INTRODUCTION** | | | | | | 9 |
| Introduction to Swarm Intelligence – Essence of an Algorithm, Algorithms and Self – Organization, Links between Algorithms and Self-Organization-Characteristics of Meta heuristics- Swarm Intelligence based algorithms – Ant Algorithms- Bee Algorithms-Particle Swarm Optimization and Krill Herd Algorithms-Strategies for state space search in AI- Depth First and Breadth First Search Heuristic Search- Best First Search and Hill Climbing. | | | | | | | |
| **UNIT-II** | **OPTIMIZATION ALGORITHM** | | | | | | 9 |
| Ant Colony Optimization (ACO) - Theoretical Considerations-Combinatorial optimization and meta heuristic-Stigmergy-Convergence Proofs-ACO Algorithm- ACO and Model Based Search-Variations Of ACO- Elitist Ant System (EAS)-Minmax Ant System (MMAS) and Rank Based Ant Colony System (RANKAS)-ACO Algorithm for Travelling Sales Person problem-ACO algorithm for feature selection. | | | | | | | |
| **UNIT-III** | **SWARM OPTIMIZATION** | | | | | | 9 |
| Particle Swarm Optimization: Principles of Bird Flocking and Fish Schooling-Evolution of PSO-Operating Principles- PSO Algorithm- Neighborhood Topologies-Convergence Criteria-Variations of PSO. | | | | | | | |

| UNIT-IV | ABC OPTIMIZATION | 9 |
|---|---|---|
| Artificial Bee Colony (ABC) Optimization - Behavior of real bees-ABC Algorithm-Variations of ABC- Abcgbest and Abcgbestdist-Case Study: Application of ABC algorithm in solving Travelling Salesman Problem-Knapsack Problem and for feature selection. | | |

| UNIT-V | HERD OPTIMIZATION TECHNIQUES | 9 |
|---|---|---|
| Krill Herd Optimization - Herding Behavior of Krill Swarms- Lagrangian Model of Krill Herding- Methodology-Application of Krill Herd Algorithm in Feature Selection. | | |
| | **TOTALHOURS** | **45** |

| **TEXTBOOKS:** | |
|---|---|
| 1 | Xin-She Yang, Zhihua Cui, Renbin Xiao, Amir Hossein Gandomi, Mehmet Karamanoglu, "Swarm Intelligence and Bio-Inspired Computation, Theory and Applications", Elsevier 2013. |
| 2 | Marco Dorigo and Thomas Stutzle, "Ant Colony Optimization", MIT Press, Cambridge, England, 2004. |
| **REFERENCES:** | |
| 1 | Ben Coppin, "Artificial Intelligence Illuminated", Jones and Bartlett Publishers, 2004. |
| 2 | Kennedy J and Russel C Eberhart, "Swarm Intelligence", Morgan Kaufmann Publishers, USA, 2001 |
| 3 | Dervis Karaboga, Bahriye Akay," A comparative study of Artificial Bee Colony Algorithm" Applied Mathematics and Computation 214, Elsevier Publications, 2009. |

**COs Vs POs and PSOs Mapping**

| Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | 2 | 2 | 3 | 3 | 3 | 2 | - |
| **CO2** | 3 | 1 | 2 | - | - | - | - | - | 1 | 1 | 3 | 3 | 3 | 2 | - |
| **CO3** | 3 | 2 | 1 | - | - | - | - | - | 1 | 1 | 3 | 3 | 2 | 2 | - |
| **CO4** | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | 2 | 3 | 2 | 3 | - |
| **CO5** | 3 | 2 | - | - | - | - | - | - | 1 | 1 | 3 | 3 | 2 | 2 | - |
| **Average** | **2.8** | **1.8** | **1.4** | **-** | **-** | **-** | **-** | **-** | **1.4** | **1.2** | **2.8** | **3** | **2** | **2** | **-** |

**1 - Low, 2 - Medium, 3 - High, '-"- No Correlation**