## 

**M.Sc., DATA SCIENCE**

Syllabus

UNIVERSITY DEPARTMENT

**Program Code: CSEE**

**2024 – 2025 onwards**



**BHARATHIAR UNIVERSITY**

**(A State University, Accredited with “A++” Grade by NAAC,**

**Ranked 21st among Indian Universities by MHRD-NIRF)**

**Coimbatore - 641 046, Tamil Nadu, India**

**BHARATHIAR UNIVERSITY : : COIMBATORE 641046**

**DEPARTMENT OF COMPUTER SCIENCE**

**(Effective from the academic Year 2024 - 2025)**

MISSION

* Creating and disseminating of world-class knowledge in the global context
* Equip students with knowledge of up-to-date technological developments to take part in the global software industry
* Promote state of art interdisciplinary research in computer science
* Imbibe entrepreneurial culture through curriculum, pedagogy, research and mentoring

1. **Eligibility for Admission to the Programme**

Candidates for admission to the first-year programme leading to the Degree of Master of Science in Data Science (M.Sc. – DS) will be required to possess:

A pass in B.Sc. Computer Science or its equivalents / B.Sc. Data Science / B.Sc. Data Analytics / B.Sc. Mathematics or its equivalents / B.Sc. Statistics or its equivalents / B.Sc. Physics / B.Sc. Electronics / B.E. / B.Tech. / CSE / IT / ECE / EEE and E&I or its equivalents.

2. **Duration of the Programme**

The programme shall be offered on a full-time basis. The programme will consist of three semesters of coursework, laboratory work, and mini projects and the fourth semester consist of project work.

3. **Regulations**

The general Regulations of the Bharathiar University Choice-Based Credit System apply to this programme.

4. **The Medium of Instruction and Examinations**

The medium of instruction and Examinations shall be in English.

5. **Submission of Record Notebooks for Practical Examinations & Project Viva-Voce.**

Candidates taking the Practical Examinations should submit Bonafide Record Note Books prescribed for the Examinations. Otherwise, the candidates will not be permitted to take the Practical Examinations.

Candidates taking the Project Viva Examination should submit Project Report prescribed for the Examinations. Otherwise, the candidates will not be permitted to take the Project Viva-voce Examination.

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| **PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)** | |
| **The M.Sc. Data Science programme describe accomplishments that graduates are expected to attain within five to seven years after graduation** | |
| PEO1 | Excel in his/her professional career and/or pursue higher education including research by applying the knowledge of data science. |
| PEO2 | Graduates will be capable to become leaders, equipped with managerial and analytical skills needed for data driven decision making. |
| PEO3 | Graduates are prepared to meet industry demand in the field of data science with proficiency in statistical methods and data analytics tools. |
| PEO4 | Graduates will be engaged in lifelong learning and progress into research and development in data analytics. |
| PEO5 | Graduates will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively. |

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| **PROGRAMME SPECIFIC OUTCOMES (PSOs)** | |
| **After the successful completion of M.Sc. Data Science programme, the students are expected to** | |
| PSO1 | Develop core competence in science, mathematics and fundamentals of data science to address ever-changing industrial requirements globally. |
| PSO2 | Develop sustainable solutions for society. |
| PSO3 | Become a skilled data scientist to meet out the industry standards. |
| PSO4 | Develop domain-specific software tools for data storage, analysis and visualization. |
| PSO5 | Able to independently carry out research/investigation to solve practical problems |

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| **Program Outcomes (POs)** | |
| On successful completion of the M. Sc. Data Science program | |
| PO1 | Gain and apply the knowledge of data science concepts in appropriate domain  of interest |
| PO2 | Ability to analyze the problem, identify the required computing facility and  implement it to obtain solutions |
| PO3 | Ability to create a new design for the complex computational problems which meets  the specific needs for environmental and societal impact domains |
| PO4 | Students can independently enable to acquire the innovative ideas and solve complex  real-time problems by considering professional, ethical, legal and social issues |
| PO5 | Understand and choose the appropriate modern techniques and tools for the complex  systems of various domains and understands the advantages and limitations |
| PO6 | Ability to work in a group with an effective rapport building with team members in computer industries to accomplish a common goal |
| PO7 | Ability to communicate effectively in the basis of presenting their research work and gain knowledge on documentation and reports writing in a professional way |
| PO8 | Ability to distinguish the ethical, legal and societal issues of computing surroundings and will take the responsibility by applying computer skill practices |
| PO9 | Ability to analyze the local and global impact of computing on individuals, organizations and society |
| PO10 | Demonstrate the principles of data science and apply these in the multidisciplinary environments to manage project |

**BHARATHIAR UNIVERSITY :: COIMBATORE 641 046**

**M.Sc. Data Science Curriculum (University Department)**

*(For the students admitted during the academic year 2024 – 2025 onwards)*

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| **Course Code** | **Title of the Course** | **Credits** | **Hours** | | **Maximum Marks** | | |
| **Theory** | **Practical** | **CIA** | **ESE** | **Total** |
| **FIRST SEMESTER** | | | | | | | |
| 24DS1C1 | Linear Algebra | 4 | 4 | - | 25 | 75 | 100 |
| 24DS1C2 | Probability and Statistics | 4 | 2 | 4 | 25 | 75 | 100 |
| 24DS1C3 | Principles of Data Science | 4 | 4 | - | 25 | 75 | 100 |
| 24DS1C4 | Database Management Systems | 4 | 2 | 4 | 25 | 75 | 100 |
| 24DS1C5 | Python and R  Programming | 4 | 2 | 4 | 25 | 75 | 100 |
| 24DS1EX | Elective-I | 4 | 4 | - | 25 | 75 | 100 |
| 1GS | General Supportive -I | 2 | 2 | - | 12 | 38 | 50 |
| PDC | Industry Literacy | 1 | - | - | 25 | - | 25 |
| 24DS1JOC1 | Job Oriented Course | 2 | 2 | - | 50 | - | 50 |
|  | **Total** | **29** |  |  |  |  | **725** |
| **SECOND SEMESTER** | | | | | | | |
| 24DS2C1 | Optimization Techniques Using MATLAB | 4 | 2 | 4 | 25 | 75 | 100 |
| 24DS2C2 | Multivariate Data Analysis | 4 | 2 | 4 | 25 | 75 | 100 |
| 24DS2C3 | Machine Learning Techniques | 4 | 2 | 4 | 25 | 75 | 100 |
| 24DS2C4 | Data Mining | 4 | 4 | - | 25 | 75 | 100 |
| 24DS2C5 | IoT Analytics | 4 | 4 | - | 25 | 75 | 100 |
| 24DS2EX | Elective-II | 4 | 4 | - | 25 | 75 | 100 |
| 2GS | General Supportive-II | 2 | 2 | - | 12 | 38 | 50 |
| 24DS2MP | Mini Project – I | 2 | - | - | 50 | - | 50 |
| 24DS2VAC1 | Value Added Course | 2 | 2 | - | 50 | - | 50 |
|  | **Total** | **30** |  |  |  |  | **750** |
| **THIRD SEMESTER** | | | | | | | |
| 24DS3C1 | Big Data Analytics | 4 | 2 | 4 | 25 | 75 | 100 |
| 24DS3C2 | Deep Learning Techniques | 4 | 2 | 4 | 25 | 75 | 100 |
| 24DS3C3 | Data Privacy and Security | 4 | 4 | - | 25 | 75 | 100 |
| 24DS3EX | Elective-III | 4 | 4 | - | 25 | 75 | 100 |
| 24DS3EX | Elective-IV | 4 | 4 | - | 25 | 75 | 100 |
| 24DS3MP | Mini Project - II | 4 | - | - | 25 | 75 | 100 |
| 3GS | General Supportive-III | 2 | 2 | - | 12 | 38 | 50 |
| PDC | Literature Survey & GAP Analysis | 1 | - | - | 25 | - | 25 |
| 24DS3JOC2 | Job Oriented Course | 2 | - | - | 50 | - | 50 |
|  | **Total** | **29** |  |  |  |  | **725** |
| **FOURTH SEMESTER** | | | | | | | |
| 24DS4PW | Project Work | 12 | - | - | 180 | 120 | 300 |
| 24DS4VAC2 | Value Added Course | 2 | - | - | 50 | - | 50 |
|  | **Total** | **14** |  |  |  |  | **350** |
|  | **Grand Total** | **102** |  |  |  |  | **2550** |

**Online Course**

|  |  |  |  |  |  |  |  |
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|  | SWAYAM – MOOC Course\* | 2 |  |  |  |  |  |

\*Swayam – Mooc online course shall be for at least 4 weeks with at least 2 credits.

The course shall be mandatory and shall be completed within the third semester (i.e., before the

beginning of the fourth semester)

**Elective Papers**

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| **Sem** | **Elective** | **Suggested Code** | **Title of the Paper** | **No. of Credits** |
| I | Elective – I | 24DS1E1 | Design of Algorithms | 4 |
| 24DS1E2 | Artificial Intelligence | 4 |
| 24DS1E3 | Business Intelligence | 4 |
| II | Elective – II | 24DS2E1 | Transforms and Applications | 4 |
| 24DS2E2 | Predictive Analytics | 4 |
| 24DS2E3 | Software Project Management | 4 |
| III | Elective – III | 24DS3E1 | Natural Language Processing | 4 |
| 24DS3E2 | Social Media Analytics | 4 |
| 24DS3E3 | Health Care Analytics | 4 |
| 24DS3E4 | Nature Inspired Computing | 4 |
| Elective – IV | 24DS3E5 | Cloud Security | 4 |
| 24DS3E6 | Sentiment Analysis | 4 |
| 24DS3E7 | Text Analytics | 4 |
| 24DS3E8 | Digital Marketing Analytics | 4 |

**List of Job Oriented/Value Added Course**

1. Data Analysis using Excel

2. Power BI for Data Analytics

3. Software Testing Tools

4. Cyber Security and Digital Forensics

5. Mobile Application Development

6. Smart Applications with the Internet of Things

7. Remote Sensing and GIS

SEMESTER - I

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| **Course code** | | | | | **24DS1C1** | | **LINEAR ALGEBRA** | **L** | | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | | **CORE** | **4** | | | | | **0** | | **0** | **4** |
| **Pre-requisite:** | | | | | | | **Basic knowledge in higher secondary algebra** | **Syllabus Version** | | | | | | **2024-25** | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| The main objectives of this course are to: 1. Learn the elementary concepts and basic ideas involved in matrix theory  2. Particular attention is given to canonical forms of linear transformations, diagonalizations of linear transformations, matrices and determinants.  3. Applications to linear models and Inner product spaces are also analyzed. | | | | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | |
| CO1 | | | Determine whether a square matrix is diagonalizable, and compute its  diagonalization. | | | | | | | | | | | | K2 | |
| CO2 | | | Find the minimal polynomial and the rational forms of a real square matrix. | | | | | | | | | | | | K3 | |
| CO3 | | | Compute the eigenvalues and eigenvectors of a square matrix and determine the dimension of the corresponding eigenspaces. | | | | | | | | | | | | K4 | |
| CO4 | | | Discuss the kernel and image of linear of a linear transformation in terms of nullity and rank of a matrix. | | | | | | | | | | | | K5 | |
| CO5 | | | Applications to linear models such as curve fitting, regression etc., | | | | | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | |
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| **Unit 1** | | | | | | **Linear Equations in Linear Algebra** | | | | | | **12 hours** | | | | |
| Systems of linear equations-Row reduction and Echelon forms-Vector Equations-Matrix equations Ax=b-Solution set of linear systems-Applications of linear systems-Linear Independence-Introduction to linear transformations-The matrix of linear transformation- | | | | | | | | | | | | | | | | |
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| **Unit 2** | | | | | | **Matrix Algebra** | | | | **14 hours** | | | | | | |
| Matrix operations-The inverse of a matrix-Characterizations of Invertible Matrices-Partitioned Matrices-Matrix factorizations-Subspaces of Rn-Dimension and Rank | | | | | | | | | | | | | | | | |
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| **Unit 3** | | | | | | **Vector Spaces** | | | | | **14 hours** | | | | | |
| Vector spaces and subspaces-Null spaces, Column spaces and linear transformations-Linearly independent sets: Bases-Coordinate systems-The dimension of a vector space-Rank-Change of Basis | | | | | | | | | | | | | | | | |
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| **Unit 4** | | | | | | **Eigenvalues and Eigenvectors** | | | | | **15 hours** | | | | | |
| Eigenvectors and Eigenvalues-The Characteristic equations-Diagonalization-Eigenvectors and linear transformations-Complex eigenvalues. | | | | | | | | | | | | | | | | |
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| **Unit 5** | | | | **Orthogonality and Least Squares** | | | | | **18 hours** | | | | | | | |
| Inner product, length and orthogonality-Orthogonal sets-Orthogonal projections-The Gram-Schmidt Process-Least square problems-Applications to linear models-Inner product spaces-Applications of Inner product spaces | | | | | | | | | | | | | | | | |
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| **Unit 6** | | | | **Contemporary Issues** | | | | | **2 hours** | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | |
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|  | | | | **Total Lecture hours** | | | | | **75 hours** | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | |
| 1 | “Linear Algebra and its Applications” by **David C. Lay, Steven R. Lay, Judi. J. Mcdonald,** Fifth Ed., 2016 Pearson.  Unit I : Chapters 1: Sections:1.1-1.9;  Unit II : Chapters 2: Sections:2.1-2.5, 2.7-2.9;  Unit III : Chapters 4: Sections:4.1-4.7;  Unit IV : Chapters 5: Sections:5.1-5.5  Unit V : Chapters 6 : Sections:6.1-6.8 | | | | | | | | | | | | | | | |
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| **Reference Book(s)** | | | | | | | | | | | | | | | | |
| 1 | **Gilbert Strang**, Introduction to Linear Algebra, Fifth Edition, 2016 | | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | <https://nptel.ac.in/courses/111104137> | | | | | | | | | | | | | | |
| 2 | | <https://nptel.ac.in/courses/111106051> | | | | | | | | | | | | | | |
| 3 | | <https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/> | | | | | | | | | | | | | | |
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| Course Designed By: **Dr. R. Rakkiyappan** | | | | | | | | | | | | | | | | |

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| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | M | S | M | M | S | M | L | M | S | M |
| CO2 | S | S | M | M | S | M | M | M | M | M |
| CO3 | M | S | L | S | M | M | M | S | S | M |
| CO4 | M | S | S | S | S | M | M | M | M | M |
| CO5 | M | S | S | S | S | L | M | S | S | S |

\* S- Strong; M-Medium; L-Low

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| **Course Code** | | | | | | **24DS1C2** | **PROBABILITY AND STATISTICS** | **L** | **T** | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | | **CORE** | **2** | **0** | **4** | | **4** |
| **Pre-requisite** | | | | | | | Basics of Mathematics and Statistics | **Syllabus Version** | | **2024-25** | | |
| **Course Objectives** | | | | | | | | | | | | |
| The main objectives of this course are to:   1. Inculcate the knowledge on descriptive statistics 2. Impart the concept of probability and its applications 3. Know the distributions and its variants 4. Learn the various sampling techniques 5. Understand the concept of inferential statistics for decision making | | | | | | | | | | | | |
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| **Expected Course Outcomes** | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | |
| 1 | | | Visualize and summarize the data | | | | | | | K1-K3 | | |
| 2 | | | Know the usage of probability concept in a given situation | | | | | | | K2-K3 | | |
| 3 | | | Select a suitable distribution and also to generate random sample | | | | | | | K3-K5 | | |
| 4 | | | Draw sample by choosing suitable sampling techniques and estimate the parameters | | | | | | | K3-K5 | | |
| 5 | | | Formulate hypothesis and perform suitable tests. | | | | | | | K2-K5 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **Unit 1** | | | | | **Descriptive Statistics** | | | | | | **12 hours** | |
| Raw Data – Graphical Plots and Charts - Frequency Distribution – Histogram and Frequency Polygons – Relative Frequency Distributions – Cumulative Frequency Distributions – Frequency Curves and Their Types - Measures of Central Tendency: Mean, Median, Mode, Trimmed Mean – Measures of Dispersion: Range, Standard Deviation, Quartile Deviation, Mean and Median Absolute Deviation – Moments - Measures of Skewness and Kurtosis – Notion of Linear Correlation and Linear Regression – Simple Problems. | | | | | | | | | | | | |
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| **Unit 2** | | | | **Basic Probability, Random Variables and Probability Distributions** | | | | | | | **12 hours** | |
| Concept of Probability – Axioms of Probability - Conditional Probability – Simple Problems - Independent Events - Bayes’ Rule (without proof) and Simple Applications. Discrete and Continuous Random Variables, Probability Distributions for Discrete and Continuous Random Variables – Distribution Functions for Discrete and Continuous Random Variables - Joint Distributions - Independent Random Variables - Probability Distributions of Functions of Random Variables – Marginal and Conditional Distributions – Mathematical Expectation. | | | | | | | | | | | | |
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| **Unit 3** | | | | **Special Probability Distributions** | | | | | | | **12 hours** | |
| Notions of Binomial, Poisson Distribution and Normal Distributions – Properties – Relationship Between Binomial and Normal Distributions, Poisson and Normal Distributions – Uniform, Exponential, Gamma Distributions, t, Chi-square and F Distributions - Bivariate Normal Distribution – Simulation: Random Number Generation from Exponential, Gamma and Normal Distributions. | | | | | | | | | | | | |
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| **Unit 4** | | | | **Sampling Theory and Statistical Estimation Theory** | | | | | | | **12 hours** | |
| Population and Sample - Random Samples – Sampling With and Without Replacement, Sampling Distributions, Sampling distributions of Mean, Proportion and Difference of Means, Standard Error. Estimation of Parameters, Properties of Estimators: Unbiasedness, Consistency, Efficiency, Sufficiency. Point and Interval Estimates and Their Reliability, Confidence Interval Estimates of Population Parameters Based on Normal, t and Chi-square Distributions. | | | | | | | | | | | | |
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| **Unit 5** | | | | **Statistical Decision Theory** | | | | | | | **12 hours** | |
| Statistical Decisions, Statistical Hypothesis, Tests of Hypothesis and Significance, One-tail and Two-tail Tests. Parametric Tests: Tests Involving Normal, t, Chi-square and F Distributions - Test for Goodness of Fit, Contingency Tables, Tests for Independence of Attributes, One-way and Two-way Analysis of Variance. Non-parametric Tests: Sign Test, Run Test, Wilcoxon Signed Rank Test, Mann-Whitney U test, Kruskal-Wallis Test. | | | | | | | | | | | | |
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| **Unit 6** | | | | **Contemporary Issues** | | | | | | | **2 hours** | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
|  | | | | | | **Total Lecture hours** | | | | | **62 hours** | |
|  | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1 | Montgomery, D. C., and Runger, G. C. (2018). Applied Statistics and Probability for Engineers, Seventh Edition, John Wiley & Sons, Inc. | | | | | | | | | | | |
| 2 | Bruce, P., Bruce, A., and Gedeck, P. (2020). Practical Statistics for Data Scientists, Second Edition, O’Reilly Media, Inc. | | | | | | | | | | | |
| 3 | Spiegel, M. R., Schiller, J. J., and Alu Srinivasan, R. (2013). Probability and Statistics, Fourth Edition, Schaum’s Outline Series, McGraw Hill Companies, Inc. | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | |
| 1 | | https://nptel.ac.in/courses/111104032 | | | | | | | | | | |
| 2 | | https://nptel.ac.in/courses/111106112 | | | | | | | | | | |
| 3 | | https://nptel.ac.in/courses/111104120 | | | | | | | | | | |
|  | | | | | | | | | | | | |
| Course Designed By: **Dr. R. Vijayaraghavan / Dr. R. Muthukrishnan** | | | | | | | | | | | | |

***Note*: This paper is application-oriented. The derivation of the formulae and equations is outside the scope of the paper and hence, it may be avoided.**

**PROBABILITY AND STATISTICS LAB**

**List of Programs**

**Problems relating to the following topics using R / Python programming shall form the basis for setting the question paper.**

1. Formation of frequency tables – one way and two-way tables.

2. Graphical and Diagrammatical representation of data - Bar plot, line plot, pie chart, multiple bar plot, stacked bar plot, histogram, frequency curves, boxplot, steam-leaf plot, scatter plot.

3. Computation of Descriptive measures – mean, median, mode, trimmed mean, range, standard deviation, median absolute deviation, quartiles and percentiles. **Computation of simple correlation and regression coefficients.**

4. Computation of probability using discrete and continuous distributions.

5. Generation of random sample from discrete and continuous distributions.

6. Selection of random sample under with and without replacement for a given data set and then estimating population parameters.

7. Parametric tests based on chi square, t and F statistics.

8. Non-Parametric Tests – Sign test, Wilcoxon tests, Mann-Whitney U test, Kruskal-Wallis test.

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | M | M | M | L | M | L | M | S |
| **CO2** | S | S | M | S | S | M | M | M | M | S |
| **CO3** | S | M | M | S | S | M | M | M | M | M |
| **CO4** | S | S | S | S | S | M | M | M | M | M |
| **CO5** | S | S | S | S | S | M | M | L | M | M |
|  |  |  |  |  |  |  |  |  |  |  |

\*S-Strong; M-Medium; L-Low

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | | **24DS1C3** | | **PRINCIPLES OF DATA SCIENCE** | **L** | | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **CORE** | **4** | | | | | **0** | | **0** | **4** |
| **Pre-requisite** | | | | Knowledge about Fundamentals of Data Base Management System | **Syllabus Version** | | | | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To provide a strong foundation for data science and its application area. 2. To understand the underlying core concepts and emerging technologies in data science. 3. To develop applied experience with data science software, programming, applications and processes. 4. To develop practical skills needed in modern analytics. 5. To give a hands-on experience with real-world data analysis. | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | |
| 1 | Understand the fundamental concepts of data science | | | | | | | | | | K2 / K5 | | |
| 2 | Apply Data analysis techniques for applications handling large data | | | | | | | | | | K3/ K4 | | |
| 3 | Understand various machine learning algorithms used in data science  process | | | | | | | | | | K5/K6 | | |
| 4 | Visualize and present the inference using various tools | | | | | | | | | | K3/K4 | | |
| 5 | Create ethics surrounding privacy, data sharing and algorithmic decision-making | | | | | | | | | | K2/K4 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**- Create | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| **Unit 1** | | | **INTRODUCTION TO DATA SCIENCE** | | | | | | **12 hours** | | | | |
| Definition – Basic Terminology- Data science Venn diagram- Types of Data- Structured versus Unstructured data- Quantitative versus Qualitative data- The Four Levels of Data- Five steps of Data Science- Data Science Process Overview –Data science classification-Data Science Algorithms- Business Intelligence and Data Science- Components of Data Science. | | | | | | | | | | | | | |
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| **Unit 2** | | | **DATA PROCESS AND EXPLORATION** | | | | | **12 hours** | | | | | |
| Introduction-Prior Knowledge-Data Preparation-Modeling-Applications-Objectives of Data Exploration-Datasets- Descriptive statistics- Data Visualization: Introduction- Types of Data visualization- Technologies for visualization - Various visualization techniques - The Five Cs of Data Visualization. | | | | | | | | | | | | | |
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| **Unit 3** | | | **DATA MODELLING AND ANALYTICS** | | | | **10 hours** | | | | | | |
| Data Science Methodology- Analytics for Data Science- Data Analytics Examples- Data Analytics Life Cycle- Data Discovery- Data preparation- Model Planning- Model Building- Operationalization. | | | | | | | | | | | | | |
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| **Unit 4** | | | **FEATURE SELECTION AND FORECASTING** | | | | **12 hours** | | | | | | |
| Introduction-Feature Selection: Classifying feature selection methods- Anomaly Detection: Introduction- Distance and Density based outlier detection-Local Outlier Factor-Timeseries Forecasting- Decomposition-Smoothing based methods-Regression based methods-Machine Learning methods. | | | | | | | | | | | | | |
| **Unit:5** | | | **DATA SCIENCE TOOLS AND APPLICATIONS** | | | **12 hours** | | | | | | | |
| Introduction to Data Science Tools- SAS- APACHE FLINK -BigML- Excel- Tableau- Matplotlib- TensorFlow- Weka- Applications: Hands-on with Solving Data Problems-Introduction-Collecting and Analyzing Twitter Data- Collecting and Analyzing YouTube Data. | | | | | | | | | | | | | |
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| **Unit:6** | | | **CONTEMPORARY ISSUES** | | | **2 hours** | | | | | | | |
| Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops | | | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | | **60 hours** | | | | | | | |
| **Text Books** | | | | | | | | | | | | | |
| 1 | Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, Fundamentals of Data Science, 1st Edition, 2022 | | | | | | | | | | | | |
| 2 | Daimi, Kevin, Ed. Hamid R. Arabnia, Principles of Data Science, Springer, 2020. | | | | | | | | | | | | |
| 3 | Vijay Kotu, Bala Deshpande, Data Science: Concepts and Practices, Morgan Kaufmann Publishers, Second edition, 2019 | | | | | | | | | | | | |
| 4 | D J Patil, Hilary Mason, Mike Loukides, Ethics and Data Science, O’ Reilly, 1st edition, 2018 | | | | | | | | | | | | |
| 5 | Sinan Ozdemir, Principles of Data Science, Packt Publishing, December 2016 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | |
| 1 | Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Mining of Massive Datasets. v2.1, Cambridge University Press, 2014. | | | | | | | | | | | | |
| 2 | Cielen, Davy, Arno DB Meysman, Mohamed Ali, Introducing Data Science: Big Data, Machine Learning, and more, using Python Tools, Manning Publications Co., 2016 | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | |
| 1 | https://onlinecourses.nptel.ac.in/noc19\_cs60/preview | | | | | | | | | | | | |
| 2 | https://www.classcentral.com/course/swayam-python-for-data-science-14266 | | | | | | | | | | | | |
| 3 | https://www.youtube.com/watch?v=7eMsa-ecJlA | | | | | | | | | | | | |
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| Course Designed By: **Dr. D. Napoleon** | | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | **S** | **S** | **S** | **S** | **M** | **M** | **S** | **S** | **S** | **M** |
| **CO2** | **S** | **M** | **M** | **S** | **S** | **S** | **S** | **M** | **M** | **S** |
| **CO3** | **S** | **M** | **L** | **M** | **S** | **S** | **M** | **M** | **S** | **S** |
| **CO4** | **S** | **S** | **M** | **L** | **L** | **S** | **S** | **M** | **S** | **S** |
| **CO5** | **M** | **S** | **L** | **M** | **M** | **S** | **S** | **L** | **L** | **M** |

**S- Strong; M-Medium; L-Low**

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| **Course Code** | | | **24DS1C4** | **DATABASE MANAGEMENT SYSTEMS** | **L** | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | **CORE** | **2** | | | **0** | **4** | **4** |
| **Pre-requisite** | | | | Knowledge on Programming Logics and Data Storage Systems | **Syllabus Version** | | | **2024-25** | | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are:   1. To teach the basic database concepts, applications, data models, schemas and instances. 2. To familiarize entity relationship model for a database. 3. To demonstrate the use of constraints and relational algebra operations. 4. To describe the basics of SQL and construct queries using SQL. 5. To demonstrate the basic concepts of transaction processing and concurrency control. 6. To emphasize the importance of normalization in databases. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | | Demonstrate the basic elements of a relational database management system. | | | K1/K2/K3 | | | | | |
| 2 | | Build and manipulate relational database using Structured Query Language. | | | K1/K2/K3/K4 | | | | | |
| 3 | | Apply normalization on database design to eliminate anomalies. | | | K2/K4/K5/K6 | | | | | |
| 4 | | Analyze the issues in transaction processing and concurrency control. | | | K3/K4/K5 | | | | | |
| 5 | | Analyze database transactions and can control them by applying ACID properties. | | | K3/K4/K5/K6 | | | | | |
| 6 | | Use the functional dependency and normalization concepts to develop real-time database applications. | | | K4/K5/K6 | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
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| **Unit 1** | | | **Introduction to Database System and ER Modeling** | | **11 Hours** | | | | | |
| Introduction to Database Management Systems, Purpose of Database Systems, View of Data, Database Languages, Database System Structure, Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys. | | | | | | | | | | |
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| **Unit 2** | | | **Structured Query Language Basics** | | **11 Hours** | | | | | |
| SQL Overview: Data Types and Literals, DDL, DML, DCL, TCL. Data Definitions, Basic Structure Operations, Additional Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-Queries. Modifications of Database: Deletion, Insertion and Updates. | | | | | | | | | | |
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| **Unit 3** | | | **Intermediate Structured Query Language** | | | | **12 Hours** | | | |
| Joins Expressions, Views, Transactions. Relational Integrity: Domain, Referential Integrities, Enterprise Constraints. Data Types and Schemas, Authorizations, Functions and Procedures, Triggers. | | | | | | | | | | |
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| **Unit 4** | | | **Relational Query Languages & Database Design** | | | | **12 hours** | | | |
| Relational Algebra, Tuple relational Calculus, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables. | | | | | | | | | | |
| **Unit 5** | | | **Relational Model Normalization** | | | | **12 hours** | | | |
| Relational Database Design Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF. | | | | | | | | | | |
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| **Unit 6** | | | **Contemporary Issues** | | | **2 hours** | | | | |
| Online Courses, Webinars and Case studies | | | | | | | | | | |
|  | | | **Total Lecture hours** | | | **60 hours** | | | | |
| **Text Book(s)** | | | | | | | | | | |
| 1 | Abraham Silberchatz, Henry K.Forth, Sudharshan, Database System Concepts, 7th edition, McGraw Hill, 2020 | | | | | | | | | |
|  | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | |
| 1 | R. Elmasri, S.B. Navathe, Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2016. | | | | | | | | | |
| 2 | Bipin C Desai, “An introduction to Database Systems”, Galgotia Publications, 2015. | | | | | | | | | |
|  | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | |
| 1 | <https://www.futurelearn.com/courses/introduction-to-databases-and-sql> | | | | | | | | | |
| 2 | <https://alison.com/courses/diploma-in-databases-and-t-sql-revised/content> | | | | | | | | | |
| 3 | <https://onlinecourses.nptel.ac.in/noc20_cs60/preview> | | | | | | | | | |
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| Course Designed By: **Dr. P. B. Pankajavalli** | | | | | | | | | | |

**DATABASE MANAGEMENT SYSTEMS LAB**

1. Implementation of DDL commands in SQL.
2. Implementation of DML commands in SQL.
3. Implementation of different types of constraints in SQL.
4. Implementation of different types of function in SQL.
5. Implementation of different types of operators in SQL
6. Implementation of different types of Joins in SQL.
7. Implementation of group by & having clause, Order by clause and Indexing in SQL.
8. Implementation of Sub queries and Views in SQL.
9. Implementation of creating procedures without a database
10. Implementation of functions in PL/SQL
11. Implementation of SQL Triggers.
12. Implementation of inserting tuples using for..loop in PL/SQL
13. Case study discussion on comparison of SQL, MySQL, PostgreSQL.

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | **S** | **S** | **L** | **M** | **S** | **L** | **L** | **L** | **M** | **S** |
| **CO2** | **S** | **S** | **M** | **M** | **S** | **L** | **L** | **M** | **M** | **S** |
| **CO3** | **S** | **S** | **S** | **S** | **S** | **L** | **L** | **M** | **S** | **S** |
| **CO4** | **S** | **S** | **S** | **S** | **S** | **L** | **L** | **M** | **S** | **S** |
| **CO5** | **S** | **S** | **S** | **S** | **S** | **L** | **M** | **M** | **S** | **S** |
| **CO6** | **S** | **S** | **S** | **S** | **S** | **M** | **M** | **S** | **S** | **S** |

**\*S-Strong; M-Medium; L-Low**

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| **Course Code** | | | | **24DS1C5** | **PYTHON AND R PROGRAMMING** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | **CORE** | 2 | 0 | | 4 | 4 |
| **Pre-requisite** | | | | | Basic knowledge on programming concepts and statistics | **Syllabus**  **Version** | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:  1. Write simple Python programs  2. Learn the conditionals, lists and classes in python  3. Familiarize with data visualization in python  4. Write simple R programs  5. Familiarize with data visualization in R. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | | Understand the concepts in python programming and apply for different problems | | | | | | | K1/K2 | |
| 2 | | Analyze the real-life problems and solve using python programming | | | | | | | K2/K4 | |
| 3 | | Apply data visualization for real time problems in python | | | | | | | K2/K3 | |
| 4 | | Understand R programming and apply for different problems | | | | | | | K2/ K3 | |
| 5 | | Create programs for appropriate problems using data visualization with R | | | | | | | K2/ K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
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| **Unit 1** | | | | **INTRODUCTION TO PYTHON** | | | | **9 hours** | | |
| Introduction to Python – Features of Python – Variables, Expressions and Statements – Order of operations – String operations - Functions – Flow of execution – Parameters and arguments | | | | | | | | | | |
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| **Unit 2** | | | | **CONDITIONALS, LISTS, CLASSES** | | | | **12 hours** | | |
| Conditionals and Recursion – Boolean expressions – Logical operators – Chained and Nested conditionals – Recursion - Iteration – Strings – Lists – Dictionaries – Tuples – Files – Classes and Objects | | | | | | | | | | |
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| **Unit 3** | | | | **NUMPY, PANDAS, MATPLOTLIB** | | | **12 hours** | | | |
| The basics of NumPy arrays – Computation on NumPy Arrays : Universal Functions – Aggregations - Broadcasting – Comparisons, Masks and Boolean logic – Fancy Indexing – Sorting Arrays – Structured Data - Data Manipulation with Pandas – Introducing Panda Objects – Data Indexing and Selection – Operating on Data in Pandas – Handling Missing Data – Hierarchical Indexing – Working with Time Series – High Performance Pandas – Visualization with Matplotlib- Simple Line Plots – Simple Scatter Plots – Visualizing Errors - Density and Contour Plots – Histograms, Binning and Density – Three Dimensional plotting in Matplotlib – Visualization with Seaborn | | | | | | | | | | |
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| **Unit 4** | | | | **INTRODUCTION TO R** | | | **12 hours** | | | |
| Basics of R – Vectors – Operations – Filtering - Matrices and Arrays – Matrix Operations - Lists – List Operations – List Components and values - Data Frames – Creation and Merging - Tables – Structures – Control Structures – Functions – Recursions. | | | | | | | | | | |
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| **Unit 5** | | | | **DATA VISUALIZATION WITH R** | | | **13 hours** | | | |
| Data Visualization with ggplot2 – aesthetic mappings - geometric objects – statistical transformations – coordinate systems - Data transformation with dplyr – Exploratory data analysis – missing values – co variation – patterns and models – ggplot2 calls | | | | | | | | | | |
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| **Unit 6** | | | **Contemporary Issues** | | | | **2 hours** | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | **Total Lecture hours** | | | | **60 hours** | | | |
| **Text Books** | | | | | | | | | | |
| 1 | Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016. | | | | | | | | | |
| 2 | Jake Vanderplas, Python Data Science Handbook: Essential Tools for Working with Data, 1st Edition, O'Reilly Media, 2016. | | | | | | | | | |
| 3 | Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, First Edition, 2011. | | | | | | | | | |
| 4 | Hadley Wickham, Garett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O’Reily Publications, First Edition, Feb 2017 | | | | | | | | | |
|  | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | |
| 1 | Reema, Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press, June 2017 | | | | | | | | | |
| 2 | Garrett Grolemund, Hands-on Programming with R: Write your own functions and simulations, O’Reilly Publisher, 2014. | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | |
| 1 | https://www.coursera.org/specializations/data-science-python?utm\_source=gg&utm\_medium=sem&utm\_campaign=29-AppliedDataSciencePython-IN&utm\_content=B2C&campaignid=12032519429&adgroupid=115699205266&device=c&keyword=python%20programming%20online&matchtype=p&network=g&devicemodel=&adpostion=&creativeid=490702858319&hide\_mobile\_promo&gclid=Cj0KCQjwgYSTBhDKARIsAB8KukvVzjEHBW73GOLTiuSYEijrAYdq94o4mIaT7E8NgVjbIWW9k\_7DXZYaAgRYEALw\_wcB | | | | | | | | | |
| 2 | https://onlinecourses.swayam2.ac.in/aic20\_sp33/preview | | | | | | | | | |
| 3 | https://onlinecourses.swayam2.ac.in/aic20\_sp35/preview | | | | | | | | | |
| 4 | https://www.coursera.org/learn/r-programming | | | | | | | | | |
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| Course Designed By: **Dr. D. Ramyachitra** | | | | | | | | | | |

**PYTHON AND R PROGRAMMING LAB**

**List of Programs**

**Python Programs**

1. Swapping of values
2. Conversion of ASCII to Binary
3. Printing the first n row of Pascal's triangle.
4. Calculation of upper case and lower-case letters in a string
5. Programs using Tuple
6. Programs using conditionals
7. Programs using dictionaries
8. Programs using Boolean operators
9. Implementation of functions
10. Programs using NumPy
11. Programs using Pandas
12. Implementation of Maclaurin series
13. Programs using seaborn
14. Programs using Matplotlib

**R Programs**

1. Vector manipulations
2. Matrix operations
3. Array Operations
4. Operations using data frame
5. Implementation of functions
6. Drawing scatter plot, box plot, violin plot, dot plot, bar plot, line plot
7. Geometric Shapes
8. Data transformations
9. Finding missing values

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | **S** | **S** | **L** | **M** | **S** | **L** | **L** | **L** | **M** | **S** |
| **CO2** | **S** | **S** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **S** |
| **CO3** | **S** | **S** | **S** | **S** | **M** | **L** | **M** | **L** | **L** | **S** |
| **CO4** | **S** | **S** | **S** | **M** | **S** | **L** | **L** | **M** | **L** | **S** |
| **CO5** | **S** | **S** | **S** | **S** | **S** | **M** | **L** | **L** | **M** | **S** |

**\*S-Strong; M-Medium; L-Low**

SEMESTER - II

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| **Course code** | | | | | **24DS2C1** | | **OPTIMIZATION TECHNIQUES USING MATLAB** | **L** | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | | **CORE** | **2** | | | | **0** | | **4** | **4** |
| **Pre-requisite** | | | | | | | **Basic knowledge in functions of one variable and under graduate real analysis** | **Syllabus Version** | | | | | **2024-25** | | |
| **Course Objectives:** | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. The student is expected to understand basic theoretical principles in optimization and fundamentals on MATLAB, primarily for numerical computing. 2. Define and use optimization terminology and concepts and understand how to classify an optimization problem. 3. To learn the characteristics of script files, functions and function files, two-dimensional plots and three-dimensional plots. 4. To implement basic optimization algorithms in MATLAB. | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | |
| CO1 | | | Understand and apply constrained and unconstrained optimization theory including  the necessary and sufficient optimality conditions and algorithms. | | | | | | | | | | | K2 | |
| CO2 | | | Explain the fundamental knowledge of Gradient Methods, Newton's Method, Conjugate Direction Methods in order to solve various optimization problems. | | | | | | | | | | | K3 | |
| CO3 | | | The ability to analyze optimization methods, including developing a model, defining an optimization problem, applying optimization methods, exploring the solution using MATLAB, and interpreting results. | | | | | | | | | | | K4 | |
| CO4 | | | Apply and evaluate optimization techniques using MATLAB to find a robust design. | | | | | | | | | | | K5 | |
| CO5 | | | To Create the acquired knowledge to select the most appropriate method to solve the practical applications. | | | | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | |
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| **Unit 1** | | | | | | **Basics of Set-Constrained and Unconstrained Optimization, One-Dimensional Search Methods** | | | | | **12 hours** | | | | |
| Introduction- Conditions for Local Minimizers. One-Dimensional Search Methods: Introduction- Golden Section Search- Fibonacci Method- Bisection Method- Newton's Method- Secant Method- Line Search in Multidimensional Optimization. | | | | | | | | | | | | | | | |
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| **Unit 2** | | | | | | **Gradient Methods, Newton's Method, Conjugate Direction Methods** | | | **14 hours** | | | | | | |
| Gradient Methods: Introduction- The Method of Steepest Descent- Analysis of Gradient Methods. Newton's Method: Introduction- Analysis of Newton's Method. Conjugate Direction Methods: Introduction- The Conjugate Direction Algorithm- The Conjugate Gradient Algorithm. | | | | | | | | | | | | | | | |
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| **Unit 3** | | | | | | **Quasi-Newton Methods, Solving Linear Equations** | | | | **14 hours** | | | | | |
| Quasi-Newton Methods: Introduction- The Rank One Correction Formula- The DFP Algorithm- The BFGS Algorithm. Solving Linear Equations: Least-Squares Analysis- The Recursive Least-Squares Algorithm- Solution to a Linear Equation with Minimum Norm- Kaczmarz's Algorithm | | | | | | | | | | | | | | | |
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| **Unit 4** | | | | | | **INTRODUCTION TO MATLAB** | | | | **15 hours** | | | | | |
| Creating Arrays, Mathematical operations with Arrays, Script and function files | | | | | | | | | | | | | | | |
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| **Unit 5** | | | | **PROGRAMMING IN MATLAB** | | | | | | **18 hours** | | | | | |
| Programming in MATLAB, 2-D and 3-D plots, Polynomials curve fitting and interpolation | | | | | | | | | | | | | | | |
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| **Unit 6** | | | | **Contemporary Issues** | | | | | | **2 hours** | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
|  | | | | **Total Lecture hours** | | | | | | **75 hours** | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | |
| 1 | “An Introduction to Optimization” by **Edwin K.P. Chong, Stanislaw H. Zag,** Fourth Ed., 2013  Unit I : Chapters6 & 7 : Sections:6.1-6.2, 7.1-7.6,7.8;  Unit II : Chapters8,9 & 10 : Sections:8.1-8.3, 9.1-9.3, 10.1-10.3,  Unit III : Chapters11 & 12 : Sections:11.1, 11.3-11.5, 12.1-12.4;  “MATLAB: An Introduction with Application” by **Amos Gilat**, John Wiley & Sons, Singapore, 2004.  Unit IV: Chapters 2,3,4,7;  Unit V : Chapters 5,6,8,10 | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | |
| 1 | **D.M. Etter, D.C. Kuncicky & H. Moore**, Introduction to MATLAB 7, Prentice Hall, New Jersey, 2004. | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | |
| 1 | | <https://nptel.ac.in/courses/111/105/111105100/> | | | | | | | | | | | | | |
| 2 | | <https://nptel.ac.in/courses/111/104/111104071/> | | | | | | | | | | | | | |
| 3 | | <http://apmonitor.com/me575/> | | | | | | | | | | | | | |
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| Course Designed By: **Dr. S. Saravanan &** **Dr. R. Rakkiyappan** | | | | | | | | | | | | | | | |

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| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| CO1 | S | S | M | S | M | M | M | S | S | M |
| CO2 | M | M | S | M | S | M | L | M | L | M |
| CO3 | S | S | M | M | L | M | M | M | M | M |
| CO4 | S | S | S | M | M | L | M | M | S | S |
| CO5 | S | M | S | S | S | M | S | S | S | S |

\* S- Strong; M-Medium; L-Low

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| **Course Code** | | | | | | **24DS2C2** | | **MULTIVARIATE DATA ANALYSIS** | **L** | **T** | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | | | **CORE** | **2** | **0** | **4** | | **4** |
| **Pre-requisite** | | | | | | | | Basics of Mathematics and Statistics | **Syllabus Version** | | **2024-25** | | |
| **Course Objectives** | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. Inculcate the knowledge on various multivariate statistical techniques and its applications 2. know the usage of dependence and interdependence multivariate methods 3. know the statistics associated with principal component and factor analysis 4. impart the regression and classification techniques 5. learn the various clustering methods | | | | | | | | | | | | | |
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| **Expected Course Outcomes** | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | |
| 1 | | | Distinguish between dependence and interdependence techniques | | | | | | | | K1-K2 | | |
| 2 | | | Fit the various regression models and predict the results | | | | | | | | K3-K6 | | |
| 3 | | | Perform the dimension reduction techniques and interpret the results | | | | | | | | K3-K6 | | |
| 4 | | | Discriminate and classify the given objects by using target variable | | | | | | | | K3-K6 | | |
| 5 | | | Form the groups by using suitable clustering techniques | | | | | | | | K3-K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | |
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| **Unit 1** | | | | | **Introduction to Multivariate Analysis** | | | | | | | **12 hours** | |
| Meaning of Multivariate Analysis – Multivariate Analysis in Statistical Terms – Basic concepts: Variate, Measurment Scales, Measurement Error, Multivariate Measurement, Statistical Significance and Statistical Power. Classification of Multivariate Techniques: Dependence and Independence Techniques – Applications of Multivariate Techniques. | | | | | | | | | | | | | |
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| **Unit 2** | | | | **Multiple Regression Analysis** | | | | | | | | **12 hours** | |
| Concept of Simple and Multiple Regressions – Illustrations. Prediction using Single and Several Independent Variables – Decision Process in Multiple Regression Analysis: Objectives, Research Design, Assumptions, Estimation of Regression Model – Assessing Model Fit – Interpretation of Regression Variate using Regression Coefficients and Assessing Multicollinearity. | | | | | | | | | | | | | |
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| **Unit 3** | | | | **Factor Analysis** | | | | | | | | **12 hours** | |
| Notion of Principal Components and Factors – Concept of Data Summarization and Data Reduction - Introduction to Principal Component Analysis and Factor Analysis – Illustrations. Decision Process in Factor Analysis: Objectives, Design, Assumptions, Deriving Factors, Interpretation of Factors, Validation of Factors – Illustrations. | | | | | | | | | | | | | |
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| **Unit 4** | | | | **Discriminant Analysis** | | | | | | | | **12 hours** | |
| Concept of Discriminant Function – Meaning of Discriminant Analysis – Decision Process in Discriminant Analysis: Objectives, Research Design, Assumptions, Estimation of Discriminant Model, Assessing Model Fit, Interpretation. | | | | | | | | | | | | | |
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| **Unit 5** | | | | **Cluster Analysis** | | | | | | | | **12 hours** | |
| Meaning and Conceptual Development of Cluster Analysis – Decision Process in Cluster Analysis: Objectives, Research Design, Assumptions, Deriving Clusters, Interpretation of Clusters, Validation and Profiling of Clusters – Illustrations – Basic Notion of Hierarchical and Non-hierarchical Clusters | | | | | | | | | | | | | |
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| **Unit 6** | | | | **Contemporary Issues** | | | | | | | | **2 hours** | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | |
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|  | | | | | | | **Total Lecture hours** | | | | | **62 hours** | |
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| **Reference Books** | | | | | | | | | | | | | |
| 1 | Hair, J. F., Black, W. C., Babin, B. J., and Anderson, R. E. (2018). Multivariate Data Analysis, Eighth Edition, Pearson. | | | | | | | | | | | | |
| 2 | Johnson, R. A., and Wichern, D. W. (2015). Applied Multivariate Statistical Analysis, Sixth Edition, Pearson. | | | | | | | | | | | | |
| 3 | Johnson, D. E. (1998). Applied Multivariate Methods for Data Analysts, First Edition, Duxbury Press. | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | |
| 1 | | https://nptel.ac.in/courses/111105091 | | | | | | | | | | | |
| 2 | | <https://builtin.com/data-science/step-step-explanation-principal-component-analysis> | | | | | | | | | | | |
| 3 | | https://nptel.ac.in/courses/110107080 | | | | | | | | | | | |
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| **Course Designed By: Dr. R. Vijayaraghavan / Dr. R. Muthukrishnan** | | | | | | | | | | | | | |

***Note*: This paper is application oriented. The derivation of the formulae and equations is outside the scope of the paper and hence, it may be avoided.**

**MULTIVARIATE DATA ANALYSIS LAB**

**Problems relating to the following topics using R / Python programming shall form the basis for setting the question paper.**

1. Computation of Mean vector and covariance matrix for multivariate data set

2. Generation of multivariate data using multivariate normal distribution

3. Fitting of linear, quadratic, exponential and logistic models

4. Principal Component analysis and factor analysis

5. Linear and quadratic discriminant analysis with classification of two and three groups.

6. Cluster analysis with hierarchical clustering (single linkage, average linkage, Wards method)

and non-hierarchical clustering (k-means)

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | S | S | M | L | L | M | S |
| **CO2** | S | S | M | M | M | S | M | M | M | M |
| **CO3** | S | S | S | M | M | M | M | M | L | S |
| **CO4** | S | S | S | S | S | S | M | M | L | S |
| **CO5** | S | S | S | M | M | M | M | M | L | S |

\*S-Strong; M-Medium; L-Low

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| **Course Code** | | | | **24DS2C3** | **MACHINE LEARNING TECHNIQUES** | **L** | | **T** | **P** | **C** | |
| **Core/Elective/Supportive** | | | | | **CORE** | **2** | | **0** | **4** | **4** | |
| **Pre-requisite** | | | | | Basic knowledge on mathematics, statistics and good analytical skills | **Syllabus**  **Version** | | | **2024-25** | | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are to:  1. Introduce the concepts of machine learning  2. Understand supervised and unsupervised learning algorithms  3. Gain knowledge on evaluation of the performance of the machine learning techniques  4. Learn about the advanced learning techniques | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | Analyze and apply the machine learning concepts for different problems | | | | | | | K3/K4 | | |
| 2 | | Understand and implement the supervised learning algorithms | | | | | | | K1/K2 | | |
| 3 | | Apply the clustering algorithms for various problems | | | | | | | K3 | | |
| 4 | | Evaluate and test the performance of the learning algorithms | | | | | | | K5 | | |
| 5 | | Design and create a learning model for real time applications | | | | | | | K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | |
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| **Unit 1** | | | | **INTRODUCTION** | | | **9 hours** | | | | |
| Introduction – Definition of learning systems – Goals and applications of Machine Learning – Types of Machine Learning – Machine Learning process – Hypothesis space and Version space | | | | | | | | | | | |
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| **Unit 2** | | | | **SUPERVISED LEARNING** | | | **12 hours** | | | | |
| Linear models for Regression – Linear models for Classification – Decision Tree Learning – Bayesian Learning – Naïve Bayes – Ensemble Methods – Bagging – Boosting – Support Vector Machines. | | | | | | | | | | | |
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| **Unit 3**  **33** | | | | **EVALUATION** | | | | **11 hours** | | | |
| Performance Evaluation metrics – ROC Curves – Validation methods – Bias-variance decomposition – Model complexity | | | | | | | | | | | |
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| **Unit 4** | | | | **UNSUPERVISED LEARNING** | | | | **12 hours** | | | |
| Clustering – K-means – K-mode- K-median – Hierarchical clustering – DBSCAN – Principal Component Analysis – Independent Component Analysis | | | | | | | | | | | |
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| **Unit 5** | | | | **ADVANCED LEARNING** | | | | **14 hours** | | | |
| Sampling – Basic sampling methods – Monte Carlo – Gibbs Sampling – Computational Learning theory – Reinforcement learning – Markov Decision Processes. | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | | | **2 hours** | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | |
|  | | | | | | | | | | |
|  | | | **Total Lecture hours** | | | | **60 hours** | | | |
| **Text Books** | | | | | | | | | | |
| 1 | Tom Mitchell, Machine Learning, McGraw-Hill, UK, 2017 | | | | | | | | | |
| 2 | Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Third Edition, 2014. | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | |
| 1 | Stephen Marsland, Machine Learning – An Algorithmic Perspective, Chapman and Hall, CRC Press, Second Edition, 2014. | | | | | | | | | |
| 2 | Shalev-Shwartz, Shai, Shai Ben-David, Understanding Machine Learning: From theory to algorithms, Cambridge University Press, 2014. | | | | | | | | | |
|  | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | |
| 1 | https://onlinecourses.nptel.ac.in/noc20\_cs29/preview | | | | | | | | | |
| 2 | https://www.coursera.org/learn/machine-learning | | | | | | | | | |
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| Course Designed By: **Dr. D. Ramyachitra** | | | | | | | | | | |

**MACHINE LEARNING TECHNIQUES - LAB**

**List or Programs**

1. Implementation of k-nearest neighbors’ classification
2. Extraction of data from database
3. Implementation of linear regression
4. Implementation of Naïve bayes theorem to classify the English text
5. Implementation of ID3 –Algorithm
6. Implementation of Support Vector Machine algorithm
7. Implementation of k – means algorithm
8. Implementation of hierarchical clustering

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | L | M | S | L | L | L | M | S |
| **CO2** | S | S | M | M | S | M | L | M | L | S |
| **CO3** | S | S | S | S | M | M | M | L | L | S |
| **CO4** | S | S | S | M | S | L | L | M | M | S |
| **CO5** | S | S | S | S | S | L | M | L | M | S |

**\*S-Strong; M-Medium; L-Low**

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| **Course Code** | | | | **24DS2C4** | | **DATA MINING** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **CORE** | **4** | **0** | | **0** | **4** |
| **Pre-requisite** | | | | | | Fundamentals of Database management | **Syllabus Version** | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are:   1. To understand the concepts of data mining, issues and applications. 2. To preprocess and analyze data, to select appropriate models and algorithms for respective applications and to develop research interest towards advances in data mining. 3. To learn various data mining techniques like classification, clustering, association rule mining. | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | | Understand the fundamental concepts of data mining and preprocessing | | | | | | K1/K2 | | |
| 2 | | | Understand the basic concepts of Association Rule Mining. Analyze and evaluate the performance of Association Rule Mining algorithms | | | | | | K2/K4/K5 | | |
| 3 | | | Understand the classification concepts and the working principles of different algorithms | | | | | | K2/K3 | | |
| 4 | | | Apply the clustering techniques to carry out simple data mining tasks and analyze their performance | | | | | | K3/K4 | | |
| 5 | | | Focus towards research and innovation | | | | | | K4/K5/K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | |
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| **Unit 1** | | | | | **INTRODUCTION AND DATA PREPROCESSING** | | | | **12 hours** | | |
| Data Mining – Kinds of data to be mined – Kinds of patterns to be mined – Technologies – Targeted Applications - Major Issues in Data Mining – Data Objects and Attribute Types – Measuring Data similarity and dissimilarity - Data Cleaning –Data Integration - Data Reduction – Data Transformation – Data Discretization. | | | | | | | | | | | |
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| **Unit 2** | | | | | **MINING FREQUENT PATTERNS AND ADVANCED PATTERN MINING** | | | | **10 hours** | | |
| Basic Concepts – Frequent Itemset Mining Methods – Pattern Evaluation Methods – Pattern Mining in Multilevel, Multidimensional space – Constraint-Based Frequent Pattern Mining – Mining Compressed or Approximate Patterns. | | | | | | | | | | | |
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| **Unit 3** | | | | | **CLASSIFICATION TECHNIQUES** | | | | **12 hours** | | |
| Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Rule-Based Classification – Model Evaluation and Selection – Techniques to Improve Classification Accuracy | | | | | | | | | | | |
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| **Unit 4** | | | | | **CLUSTERING TECHNIQUES** | | | | **12 hours** | | |
| Cluster Analysis – Partitioning Methods - Hierarchical Methods – Density-Based Methods | | | | | | | | | | | |
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| **Unit 5** | | | | | **DATA MINING TRENDS AND RESEARCH FRONTIERS** | | | | **12 hours** | | |
| Mining Complex Data Types - Other Methodologies - Data Mining Applications - Data Mining and  Society – Data Mining Trends | | | | | | | | | | | |
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| **Unit 6** | | | | | **Contemporary Issues** | | | | **2 hours** | | |
| Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops | | | | | | | | | | | |
|  | | | | | | | | | | | |
|  | | | | | **Total Lecture hours** | | | | **60 hours** | | |
| **Text Books** | | | | | | | | | | | |
| 1 | Jiawei Han, Micheline Kamber and Jian Pie, Data Mining Concept and Techniques, Morgan and Kaufmann Publisher, Third Edition, 2012 | | | | | | | | | | |
| 2 | Arun K Pujari, Data Mining Techniques, Second Edition, Universities Press India Pvt. Ltd. 2010. | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1 | Daniel T. Larose and Chantal D. Larose, Data Mining and Predictive Analytics, Wiley Series on Methods and Applications in Data Mining, Wiley Publications | | | | | | | | | | |
| 2 | Margaret H. Dunham, Data Mining Introductory and Advanced Topics, Pearson Education  2004. | | | | | | | | | | |
| 3 | Mark A. Hall, Ian H. Witten, Eibe Frank (2011). Data Mining: Practical Machine Learning Tools and Techniques, 3/e, Morgan Kaufmann Publishers, San Francisco | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
| 1 | | https://onlinecourses.nptel.ac.in/noc21\_cs06/preview | | | | | | | | | |
| 2 | | https://www.coursera.org/specializations/data-mining | | | | | | | | | |
| 3 | | https://www.mygreatlearning.com/academy/learn-for-free/courses/data-mining1 | | | | | | | | | |
| 4 | | https://www.javatpoint.com/data-mining | | | | | | | | | |
| 5 | | https://www.tutorialspoint.com/data\_mining/index.htm | | | | | | | | | |
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| Course Designed By: **Dr. S. Vijayarani** | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | **S** | **M** | **S** | **L** | **L** | **M** | **S** | **L** | **M** | **L** |
| **CO2** | **S** | **M** | **S** | **L** | **M** | **M** | **S** | **M** | **M** | **S** |
| **CO3** | **S** | **L** | **S** | **M** | **M** | **M** | **S** | **S** | **M** | **S** |
| **CO4** | **S** | **M** | **S** | **M** | **M** | **S** | **S** | **M** | **L** | **M** |
| **CO5** | **S** | **L** | **S** | **M** | **S** | **S** | **S** | **M** | **S** | **S** |

**S- Strong; M-Medium; L-Low**

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| **Course Code** | | | **24DS2C5** | **IOT ANALYTICS** | **L** | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **CORE** | **4** | | | | **0** | | **0** | **4** |
| **Pre-requisite** | | | | Knowledge on basic terminologies and concepts in Data Science, In depth knowledge on IoT | **Syllabus Version** | | | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | | |
| The main objectives of this course are:   1. To understand IoT analytics, challenges, and connectivity protocols. 2. To introduce IoT cloud and big data integration techniques and services. 3. To inculcate knowledge on creating cloud analytics environment. 4. To explore and visualize of IoT data. 5. To familiarize with IoT analytics applications. | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | |
| 1 | | Understand the concepts and techniques of IoT Data Analytics Lifecycle and Machine Learning Application in IoT. | | | | | | | | K1/K2 | | |
| 2 | | Develop cognitive IoT solutions, leveraging artificial intelligence and data science. | | | | | | | | K3/K4/K6 | | |
| 3 | | Examine concepts of cloud based IoT, big data and IoT in various domains | | | | | | | | K2/K4/K5/K6 | | |
| 4 | | Propose new strategies for organizations to optimize cost benefits using IoT data. | | | | | | | | K3/K4/K5/K6 | | |
| 5 | | Explore end-to-end data science industry use cases using the data analytics lifecycle. | | | | | | | | K2/K3/K4 | | |
| 6 | | Expose the importance of Data Analytics in IoT with respect to multiple applications | | | | | | | | K4/K5/K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **Unit 1** | | | **Introduction to Internet of Things and Analytics** | | **12 hours** | | | | | | | |
| Introduction to Internet of Things (IoT): Concepts and Definition of IoT – IoT Devices - IoT Networking Connectivity Protocols – IoT Data Messaging Protocols – MQTT, CoAP. IoT Analytics: Data vs big data- Challenges of IoT Analytics Applications - IoT Analytics Lifecycle and Techniques. | | | | | | | | | | | | |
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| **Unit 2** | | | **IoT Cloud and Big Data Integration** | | **12 hours** | | | | | | | |
| IoT Cloud and Big Data Integration: Cloud based IoT platform – Data Analytics for IoT – Data Collection – WAZIUP software Platform – Ikaas Software Platform - Elastic analytics concepts – designing for scale – Cloud security and analytics – AWS overview - AWS key services for IoT analytics. | | | | | | | | | | | | |
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| **Unit 3** | | | **Strategies and Techniques in Data Collection** | | | | | **12 hours** | | | | |
| Strategies and Techniques in Data collection: Designing Data Processing for Analytics – Applying Big Data to Storage – Apache Spark for IoT Data Processing - Solving Industry Specific Problems. | | | | | | | | | | | | |
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| **Unit 4** | | | **Geospatial Analytics to IoT Data** | | | | **10 hours** | | | | | |
| Geospatial Analytics to IoT Data: Basics – Vector and Raster Based Methods – Processing Geospatial Data. Data Science for IoT Analytics – Machine Learning Basic – Forecasting IoT data using ARIMA – Deep learning with IoT data. | | | | | | | | | | | | |
| **Unit 5** | | | **Applications & Case Studies** | | | | **12 hours** | | | | | |
| Applications & Case Studies: Data Analysis in Smart Building – Internet of Things Analytics for Smart Cities – IoT Analytics: From Data Collection to Deployment and Operationalization. | | | | | | | | | | | | | |
| **Unit 6** | | | **Contemporary Issues** | | | **2 Hours** | | | | | | | |
| Online courses, Webinars and Real time scenarios in IoT Analytics | | | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | | **60 hours** | | | | | | | |
| **Text Book** | | | | | | | | | | | | | |
| 1 | Andrew Minteer, Analytics for the Internet of things, Packt publishing, 2017. | | | | | | | | | | | | |
| 2 | John Soldatos, Building Blocks for IoT Analytics, River Publishers, 2016. | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | |
| 1 | Rajkumar Buyya, Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Elsevier, 2016. | | | | | | | | | | | | |
| 2 | R. Chandrasekaran, Essentials of Cloud computing, 2nd Edition, Chapman and Hall/CRC, 2015. | | | | | | | | | | | | |
| 3 | Amita Kapoor, Hands on Artificial intelligence for IoT, 1st Edition, Packt Publishing, 2019. | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | |
| 1 | <https://www.udemy.com/course/data-analytics-in-internet-of-things-iot/> | | | | | | | | | | | | |
| 2 | <https://www.coursera.org/lecture/aws-iot-developing-and-deploying-an-internet-of-things/iot-analytics-part-1-p5qoe> | | | | | | | | | | | | |
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| Course Designed By: **Dr. P. B. Pankajavalli** | | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | S | S | M | M | S | M | S |
| **CO2** | S | S | S | S | S | M | S | M | S | S |
| **CO3** | S | S | S | S | S | M | S | S | S | S |
| **CO4** | S | S | S | S | S | S | S | S | S | S |
| **CO5** | S | S | S | S | S | S | S | S | S | S |
| **CO6** | S | S | S | S | S | M | M | L | S | S |

**\*S-Strong; M-Medium; L-Low**

SEMESTER - III

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| **Course Code** | | | | **24DS3C1** | | **BIG DATA ANALYTICS** | **L** | **T** | | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **CORE** | **2** | **0** | | | **4** | **4** |
| **Pre-requisite** | | | | | | Basics of Big Data, Technologies and Applications | **Syllabus Version** | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | | |
| The main objectives of this course are:   1. To provide in depth knowledge about the basic concepts of Big Data, characteristics and industry examples. 2. To discuss the Hadoop framework, HDFS and MapReduce. 3. To inculcate HBase, Cassandra, HiveQL, Pig, and Neo4j data models. 4. To understand the need and application of Map Reduce. 5. To know about the research that requires the integration of large amounts of data. | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | |
| 1 | | | Understand about basics of Big Data, Technologies and Applications in various domains. | | | | | | | K2 | | |
| 2 | | | Understand the foundations of Hadoop and Hadoop Distributed File System. Design of HDFS and file-based data structures. | | | | | | | K2/K3/ K4 | | |
| 3 | | | Analyze the working of Map Reduce and YARN for job scheduling. | | | | | | | K2/K3/K4 | | |
| 4 | | | Evaluate the need and fundamentals of HBase. Apply the Cassandra data model for different applications. Understand the basic commands in HiveQL, Pig and Pig Latin. | | | | | | | K2/K3/K4 | | |
| 5 | | | Analyze the basic concepts and need for Graph databases, create databases and retrieve records using Neo4j. Understand the data visualization and its need. | | | | | | | K2/K3/K4 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | |
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| **Unit 1** | | | | | **Introduction to Big Data** | | | | **10 hours** | | | |
| Introduction: What is big data – why big data – convergence of key trends - unstructured data – industry examples of big data – Web analytics - big data and marketing – fraud and big data - risk and big data – credit risk management – big data and algorithmic trading - big data and healthcare – big data in medicine – advertising and big data – big data technologies - cloud and big data– mobile business intelligence – crowd sourcing analytics. | | | | | | | | | | | | |
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| **Unit 2** | | | | | **Hadoop** | | | **12 hours** | | | | |
| History of Hadoop - The Hadoop Distributed File System – components of Hadoop - Analyzing the Data with Hadoop - Design of HDFS – HDFS concepts - Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures. | | | | | | | | | | | | |
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| **Unit 3** | | | | | **MapReduce** | | | **15 hours** | | | | |
| MapReduce: MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution –MapReduce types – input formats – output formats. | | | | | | | | | | | | |
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| **Unit 4** | | | | | **Hadoop Eco System** | | | **10 hours** | | | | |
| HBase – data model and implementations – HBase clients – HBase examples. Cassandra – Cassandra data model –Cassandra examples – Cassandra clients –Hadoop integration. 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-case study. | | | | | | | | | | | | |
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| **Unit 5** | | | | | **Graph Databases** | | | **11 hours** | | | | |
| Introduction - Neo4J - Key concept and characteristics -Modeling data for neo4j - Importing data into neo4j - visualizations - neo4j - Cypher Query Language –data visualization. | | | | | | | | | | | | |
| **Unit 6** | | | | | **Contemporary Issues** | | | **2 hours** | | | | |
| Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | | **60 hours** | | | | |
| **Text Books** | | | | | | | | | | | | |
| 1 | Daimi, Kevin, Hamid R. Arabnia, Principles of Data Science. Ed. Springer, 2020. | | | | | | | | | | | |
| 2 | SinanOzdemir, Principles of Data Science: Mathematical Techniques and Theory to Succeed in Data-Driven Industries, Packt Publishing Limited, 2016 | | | | | | | | | | | |
| 3 | Rik Van Bruggen, Learning Neo4j, Second Edition, PacktPubishers, 2014. | | | | | | | | | | | |
| 4 | Michael Minelli, Michelle Chambers, Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley, 2013. | | | | | | | | | | | |
| 5 | Tom White, “Hadoop: The Definitive Guide”, Fourth Edition, O′Reilly Publishers, 2012. | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | |
| 1 | Andreas Francois Vermeulen, Ankurgupta, Cindy Gross, David Kjerrumgaard and Scott Shaw, Practical Hive: A Guide to Hadoop’s Data Warehouse System, Apress Media publishers, 2016 | | | | | | | | | | | |
| 2 | Eric Lubow and Russell Baradberry, Practical Cassandra: A Developer’s Approach, Addison Wesley publishers, 2014. | | | | | | | | | | | |
| 3 | EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley publishers, 2015. | | | | | | | | | | | |
| 4 | Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Publishers, 2015. | | | | | | | | | | | |
| 5 | Kim H. Pries and Robert Dunnigan, Big Data Analytics: A Practical Guide for Managers, CRC Press, 2015. | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | |
| 1 | | TEL, Websites etc.] 1 https://nptel.ac.in/courses/106/104/106104189/ | | | | | | | | | | |
| 2 | | https://www.edureka.co/blog/big-data-tutorial | | | | | | | | | | |
| 3 | | https://www.coursera.org/learn/big-data-introduction | | | | | | | | | | |
| 4 | | https://nptel.ac.in/courses/106107220 | | | | | | | | | | |
| Course Designed By: **Dr. D. Napoleon** | | | | | | | | | | | | |

**BIG DATA ANALYTICS LAB**

**List of Programs**

1. Installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as adding files and directories, retrieving files and deleting files.
3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
4. Hive Installation and Table Operations.
5. Hive Databases, Tables, Views, Functions and Indexes.
6. Neo4j - Crud operations using datasets; Find a relationship between datasets; Construct a graph; String and aggregation operations.
7. Pig Latin scripts - sort, group, join, project, and filter operations.
8. Installation of Cassandra and perform key space and table operation; Crud operations
9. Installation of Hbase and simple operations.

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | **S** | **M** | **S** | **S** | **M** | **L** | **M** | **L** | **M** | **L** |
| **CO2** | **S** | **M** | **M** | **S** | **S** | **M** | **S** | **L** | **M** | **M** |
| **CO3** | **S** | **L** | **S** | **M** | **S** | **L** | **L** | **M** | **S** | **M** |
| **CO4** | **S** | **M** | **S** | **M** | **M** | **M** | **S** | **S** | **M** | **M** |
| **CO5** | **S** | **L** | **S** | **M** | **M** | **S** | **M** | **S** | **S** | **M** |

**S- Strong; M-Medium; L-Low**

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| **Course Code** | | | **24DS3C2** | **DEEP LEARNING TECHNIQUES** | **L** | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | **CORE** | **2** | | | **0** | **4** | **4** |
| **Pre-requisite** | | | | Basic knowledge on mathematics, statistics and machine learning concepts | **Syllabus**  **Version** | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | |
| The main objectives of this course are to:  1. Understand the principles of neural networks  2. Understand the basic concepts of deep learning  3. Understand and implement the architectures of deep learning.  4. Familiarize with the applications of deep learning | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | Understand the deep learning concepts and apply for different problems | | | | | | | K2/K3 | | |
| 2 | Design and apply Convolutional and Recurrent Neural Networks | | | | | | | K1/K3 | | |
| 3 | Understand and evaluate different deep learning architectures | | | | | | | K2/K5 | | |
| 4 | Design and create deep learning applications | | | | | | | K6 | | |
| 5 | Analyze the role of deep learning models in image processing | | | | | | | K4 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
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| **Unit 1** | | **BASICS OF NEURAL NETWORKS** | | | | **9 hours** | | | | |
| Basics of neural networks - Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks. | | | | | | | | | | |
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| **Unit 2** | | **INTRODUCTION TO DEEP LEARNING** | | | | **12 hours** | | | | |
| Introduction to deep learning - Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Mitigation – RelU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization – Dropout. | | | | | | | | | | |
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| **Unit 3** | | **CONVOLUTIONAL & RECURRENT NEURAL NETWORK** | | | | | **11 hours** | | | |
| Convolutional neural networks - Kernel Filters – Multiple Filters - CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning - Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, RNN applications | | | | | | | | | | |
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| **Unit 4** | | **DEEP LEARNING ARCHITECTURES** | | | | | **12 hours** | | | |
| LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard- Sparse – Denoising – Contractive- Variational Autoencoders – Adversarial Generative Networks – Autoencoder and DBM | | | | | | | | | | |
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| **Unit 5** | | **APPLICATIONS OF DEEP LEARNING** | | | | | **14 hours** | | | |

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| Applications of deep learning - Image Segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks – Video to Text with LSTM Models – Attention Models for Computer Vision | | | |
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| **Unit 6** | | **Contemporary Issues** | **2 hours** |
| Expert lectures, online seminars - webinars | | | |
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|  | | **Total Lecture hours** | **60 hours** |
| **Text Book(s)** | | | |
| 1 | Ian Good Fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017. | | |
| 2 | Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016. | | |
|  | | | |
| **Reference Books** | | | |
| 1 | Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018. | | |
| 2 | Phil Kim, “Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence”, Apress , 2017. | | |
| 3 | Ragav Venkatesan, Baoxin Li, “Convolutional Neural Networks in Visual Computing”, CRC Press, 2018. | | |
| 4 | Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018. | | |
| 5 | Joshua F. Wiley, “R Deep Learning Essentials”, Packt Publications, 2016. | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | https://onlinecourses.nptel.ac.in/noc20\_cs11/preview | | |
| 2 | https://www.coursera.org/specializations/deep-learning | | |
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| Course Designed By: **Dr.D.RAMYACHITRA** | | | |

**DEEP LEARNING TECHNIQUES LAB**

**List of Programs**

1. Implementation of feed forward neural network
2. Implementation of convolutional neural network
3. Image classification
4. Image segmentation
5. Time series forecasting
6. Text classification and machine translation
7. Text generation
8. Image generation

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | L | M | S | L | L | L | M | S |
| **CO2** | S | S | M | M | S | L | L | M | L | M |
| **CO3** | S | M | S | S | M | M | M | L | M | S |
| **CO4** | S | S | S | S | S | L | L | M | M | S |
| **CO5** | S | S | S | S | M | L | M | L | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | | **24DS3C3** | | **DATA PRIVACY AND SECURITY** | | | **L** | | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **CORE** | | | **4** | | | | **0** | **0** | **4** |
| **Pre-requisite** | | | | | | Basic knowledge about databases, data structures and networking concepts | | | **Syllabus Version** | | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To understand the importance of data privacy and security. 2. To learn about the privacy preservation methods for protecting various kinds of data 3. To study the significant privacy regulations. 4. To implement security policies and security controls for information and system protection | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | |
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| 1 | | | Understand the need for data sharing. Analyze the necessity of different privacy-preserving methods | | | | | | | | | K1 / K4 | | | |
| 2 | | | Apply the privacy-preserving methods for various types of data and evaluate their performance | | | | | | | | | K2/K3/K5 | | | |
| 3 | | | Understand the privacy regulations formed by the different countries | | | | | | | | | K2 / K3 | | | |
| 4 | | | Remember and evaluate the security policies. Identify the system vulnerabilities | | | | | | | | | K1/K5/K6 | | | |
| 5 | | | Assess the security using tools. Apply the information security policies and standards for device management | | | | | | | | | K5/K4/K6 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | |
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| **Unit 1** | | | | | **Introduction** | | | | | | **10 hours** | | | | |
| Data Privacy and its Importance - Need for Sharing Data - Methods of Protecting Data - Importance of Balancing Data Privacy and Utility – Introduction to Anonymization Design Principles - Nature of Data in the Enterprise Static Data Anonymization on Multidimensional Data: Introduction - Classification of Privacy Preserving Methods - Classification of Data in a Multidimensional Data Set - Group-Based Anonymization | | | | | | | | | | | | | | | |
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| **Unit 2** | | | | | **Static Data Anonymization on Complex Data Structures** | | | | | **12 hours** | | | | | |
| Introduction - Privacy Preserving Graph Data - Privacy Preserving Time Series Data - Privacy Preservation of Longitudinal Data - Privacy Preservation of Transaction Data - Static Data Anonymization: Threats to Anonymized Data - Threats to Data Structures - Threats by Anonymization Techniques | | | | | | | | | | | | | | | |
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| **Unit 3** | | | | | **Privacy Regulations** | | | **12 hours** | | | | | | | |
| Introduction - UK Data Protection Act 1998. - Federal Act of Data Protection of Switzerland 1992 - Payment Card Industry Data Security Standard (PCI DSS) - The Health Insurance Portability and Accountability Act of 1996 (HIPAA): Effects of Protection - Anonymization Considerations - Anonymization Design for HIPAA - Explicit Identifiers - Quasi-Identifiers - Sensitive Data. - Anonymization Design Checklist | | | | | | | | | | | | | | | |
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| **Unit 4** | | | | | **Data Security** | | | **12 hours** | | | | | | | |
| Securing Unstructured Data: Structured Data vs. Unstructured Data – At Rest, in Transit and in Use – Approaches to secure Unstructured Data – Newer Approaches to Secure Unstructured Data. Information Rights Management: Overview – IRM Technology Details – Getting Started with IRM. Encryption: History of Encryption – Symmetric Key Cryptography - Public Key Cryptography | | | | | | | | | | | | | | | |
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| **Unit 5** | | | | | **Storage and Database Security** | | **12 hours** | | | | | | | | |
| Storage Security: Evolution – Modern Storage Security – Risk Remediation – Best Practices. Database Security: General Concepts – Database Security Layers – Database-Level Security – Database Backup and Recovery – Database Auditing and Monitoring | | | | | | | | | | | | | | | |
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| **Unit 6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **60 hours** | | | | | | | | |
| **Text Books** | | | | | | | | | | | | | | | |
| 1 | Venkataramanan, Nataraj, and Ashwin Shriram. Data Privacy: Principles and Practice. CRC Press, 2017. | | | | | | | | | | | | | | |
| 2 | Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, And Information Security Management: Concepts and Practice. New York, McGraw-Hill, 2013. | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | |
| 1 | David Salomon, Data Privacy and Security, Springer, 2003 | | | | | | | | | | | | | | |
| 2 | Andrew Vladimirov Michajlowski, Konstantin, Andrew A. Vladimirov, and Konstantin V. Gavrilenko. Assessing Information Security: Strategies, Tactics, Logic and Framework. IT Governance Ltd, 2010 | | | | | | | | | | | | | | |
| 3 | William Stallings, Lawrie Brown, Computer Security: Principles and Practice, 3rd edition, Pearson, 2014. | | | | | | | | | | | | | | |
| 4 | Serge Gutwirth, Ronald Leenes, Paul De Hert, Data Protection on the Move – Current Developments in ICT and Privacy/Data Protection, Springer, 2016 | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | |
| 1 | | https://onlinecourses.nptel.ac.in/noc22\_cs37/preview | | | | | | | | | | | | | |
| 2 | | https://onlinecourses.nptel.ac.in/noc21\_cs28/preview | | | | | | | | | | | | | |
| 3 | | https://www.coursera.org/learn/privacy-law-data-protection | | | | | | | | | | | | | |
| 4 | | https://www.coursera.org/learn/data-security-privacy | | | | | | | | | | | | | |
| 5 | | https://www.edx.org/learn/data-privacy | | | | | | | | | | | | | |
| 6 | | https://www.udemy.com/course/data-security-and-privacy-training/ | | | | | | | | | | | | | |
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| Course Designed By: **Dr. S. Vijayarani** | | | | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **M** | **M** | **M** | **S** | **S** | **L** | **M** | **L** |
| CO2 | **S** | **M** | **S** | **S** | **M** | **S** | **L** | **M** | **S** | **S** |
| CO3 | **S** | **S** | **M** | **S** | **S** | **M** | **M** | **S** | **L** | **M** |
| CO4 | **S** | **M** | **S** | **M** | **L** | **S** | **L** | **M** | **S** | **S** |
| CO5 | **S** | **M** | **L** | **S** | **S** | **M** | **S** | **S** | **M** | **M** |

**S- Strong; M-Medium; L-Low**

ELECTIVE

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| **Course code** | | | | **24DS1E1** | | **DESIGN OF ALGORITHMS** | | | **L** | | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **ELECTIVE** | | | **4** | | | | **0** | | **0** | **4** |
| **Pre-requisite** | | | | | | Basic knowledge of programming, data structures and mathematics | | | **Syllabus Version** | | | | | **2024-25** | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To understand and apply the algorithm analysis techniques. 2. To analyze the efficiency of alternative algorithmic solutions for the same problem. 3. To implement different algorithm design techniques. 4. To identify the limitations of Algorithmic power. | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | |
| 1 | | | Understand the algorithm basics and the procedure to analyze the efficiency of the algorithms. | | | | | | | | | K1/K2/K4 | | | | |
| 2 | | | Understand the Divide-and-conquer method and apply the algorithms for solving problems. Analyze the efficiency of the different methods | | | | | | | | | K2/K3/K4 | | | | |
| 3 | | | Analyze the Greedy algorithms and evaluate their performance | | | | | | | | | K4 / K5 | | | | |
| 4 | | | Apply, Analyze and Evaluate the Dynamic Programming algorithms for handling various real time problems | | | | | | | | | K4/K5/K6 | | | | |
| 5 | | | Analyze and evaluate the efficiency of Backtracking algorithms | | | | | | | | | K4 / K5 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Introduction** | | | | | | **12 hours** | | | | | |
| Introduction: Definition, Structure and Properties of algorithms –Development of an algorithm – Data Structures and algorithms –Data Structure definition and classification. Analysis of algorithms: Efficiency of algorithms –Apriori analysis –Asymptotic notations –Time complexity of an algorithm using O notation –Polynomial Vs Exponential algorithms –Average, Best and Worst-case complexities –Analyzing recursive programs. | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Divide and Conquer** | | | | | **10 hours** | | | | | | |
| Divide and Conquer: General Method, Binary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort. | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Greedy Method** | | | **12 hours** | | | | | | | | |
| Greedy Method: General Method, Knapsack Problem, Minimum Cost Spanning Tree, Single Source Shortest Paths. | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **Dynamic Programming** | | | **12 hours** | | | | | | | | |
| Dynamic Programming: General Method –Multistage Graphs –All Pair Shortest Path –Traveling Salesman Problem – Optimal Binary Search Trees. | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Back Tracking** | | **12 hours** | | | | | | | | | |
| Backtracking: General Method –8-Queens Problem –Sum of Subsets – Hamiltonian Cycles. Branch and Bound: The Method –0/1 Knapsack Problem –Traveling Salesperson Problem | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops | | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **60 hours** | | | | | | | | | |
| **Text Books** | | | | | | | | | | | | | | | | |
| 1 | E Horowitz, S Sahani S Rajasekaran, “Fundamentals of Computer Algorithms”, 2E, Universities Press | | | | | | | | | | | | | | | |
| 2 | GAV Pai, Data Structures and Algorithms Concepts, Techniques and Applications, Tata McGraw Hill, 2008 | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | |
| 1 | Robert Sedgewick, Phillipe Flajolet, “An Introduction to the Analysis of Algorithms”, Second Edition, Addison- Wesley Professional, 2013 | | | | | | | | | | | | | | | |
| 2 | Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, Algorithms, Prentice Hall of India Publications, New-Delhi | | | | | | | | | | | | | | | |
| 3 | Sara Baase and Allen Van Gelder, Computer Algorithms: Introduction to Design and Analysis, Pearson education (Singapore) Pte. Ltd, New Delhi | | | | | | | | | | | | | | | |
| 4 | Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, The Design and Analysis of Computer Algorithms, Pearson Education (Singapore) Pte. Ltd New Delhi. | | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | https://nptel.ac.in/courses/106106131 | | | | | | | | | | | | | | |
| 2 | | https://www.edx.org/course/algorithm-design-and-analysis | | | | | | | | | | | | | | |
| 3 | | https://www.udemy.com/course/design-and-analysis-of-algorithm-/ | | | | | | | | | | | | | | |
| 4 | | https://www.coursera.org/specializations/algorithms | | | | | | | | | | | | | | |
| 5 | | https://ocw.mit.edu/courses/6-046j-design-and-analysis-of-algorithms-spring-2015/ | | | | | | | | | | | | | | |
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| Course Designed By: **Dr. S. Vijayarani** | | | | | | | | | | | | | | | | |

**Mapping with Programme Outcomes:**

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| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **M** | **M** | **M** | **S** | **L** | **L** | **M** | **L** |
| CO2 | **S** | **S** | **S** | **S** | **M** | **L** | **L** | **M** | **S** | **S** |
| CO3 | **M** | **S** | **S** | **S** | **S** | **M** | **M** | **M** | **L** | **M** |
| CO4 | **S** | **M** | **S** | **M** | **L** | **L** | **L** | **M** | **S** | **S** |
| CO5 | **S** | **M** | **L** | **S** | **S** | **M** | **S** | **S** | **M** | **M** |

**S- Strong; M-Medium; L-Low**

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| **Course Code** | | | **24DS1E2** | **ARTIFICIAL INTELLIGENCE** | **L** | **T** | | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **ELECTIVE** | **4** | **0** | | | **0** | **4** |
| **Pre-Requisite** | | | | Basic knowledge on understanding and analysing the problems strategies. | **Syllabus Version** | | | | **2024-25** | |
| **Course Objective:** | | | | | | | | | | |
| The main objectives of this course are:   1. To inculcate the knowledge on approaching and solving the problems using intelligent approach. 2. To provide depth understanding on knowledge representation, inference and learning. 3. To understand the control strategies in planning and production system. 4. To motivate the students to develop models for AI with Expert systems for real world problems. | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | |
| 1 | Understand the AI foundations, problem-solving strategies using agents and search strategies | | | | | | | K1/K2 | | |
| 2 | Present the search strategies for complex environment, game playing and different knowledge representations. | | | | | | | K1/K2 | | |
| 3 | Provide knowledge on knowledge reasoning and planning, handling uncertainty and knowledge inference methods. | | | | | | | K2/K4 | | |
| 4 | Understand the production control strategies and algorithms for planning. | | | | | | | K2/K3/K4 | | |
| 5 | Design and Implement expert systems by building the knowledge base and the inferencing engine. | | | | | | | K3/K4/K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | |
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| **Unit 1** | **PROBLEM SOLVING** | | | | | | | **10 hours** | | |
| Introduction to AI- Foundations of AI – Risks and benefits of AI - Agents and Environments – Structure of Agents - Uninformed Search Strategies- Informed Search Strategies- Heuristic functions - Local Search Algorithm. | | | | | | | | | | |
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| **Unit 2** | **SEARCH IN COMPLEX ENVIRONMENT, GAMES AND KNOWLEDGE REPRESENTATION** | | | | | | | **12 hours** | | |
| Introduction to Game Playing-Alpha Beta Pruning- Constraint Satisfaction Problems - Knowledge Representation using First order logic- Knowledge Engineering in First Order Logic-Proportional vs First Order Logic. | | | | | | | | | | |
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| **Unit 3** | **KNOWLEDGE REASONING AND PLANNING** | | | | | | | **13 hours** | | |
| Inference- Forward and Backward Chaining-Unification-Uncertainty-Inference in Bayesian Network – Inference in Temporal models – Hidden Markov Models – Kalman Filters – Dynamic Bayesian Networks – Combining Beliefs and desires under uncertainty – Decision Networks. | | | | | | | | | | |
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| **Unit 4** | **PRODUCTION SYSTEM AND PLANNING** | | | | | | | **13 hours** | | |
| Introduction to Production system-control strategies-Rete Algorithm-Planning-STRIPS- Planning with state space search-Partial Order Planning-Planning Graphs-Planning, acting in the real world. | | | | | | | | | | |
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| **Unit 5** | **EXPERT SYSTEM** | | | | | | | **12 hours** | | |
| Expert System- Architecture and Roles of Expert System-Typical Expert System-MYCIN- XOON-DART Case Study-Construction of simple reflex agent with sensor and actuator using Arduino. | | | | | | | | | | |
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| **Unit 6** | | **Contemporary Issues** | | | | | **2 hours** | | | |
| Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops | | | | | | | | | | |
| **Total Lectures** | | | | | | | | **62 hours** | | |
| **Text Books** | | | | | | | | | | |
| 1 | Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, 3rd Edition, Pearson Education / Prentice Hall of India, 2010. | | | | | | | | | |
| 2 | Joseph C. Giarratano, Gary D. Riley,” Expert Systems: Principles and Programming”, 4th Edition, 2015. | | | | | | | | | |
| **Reference Books** | | | | | | | | | | |
| 1 | Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Harcourt Asia Pvt. Ltd., 2000. | | | | | | | | | |
| 2 | Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill- 2008. | | | | | | | | | |
| 3 | W. Patterson, ‘Introduction to Artificial Intelligence and Expert Systems’, Prentice Hall of India, 2007 | | | | | | | | | |
| 4 | Prateek Joshi, “Artificial Intelligence with Python”, Packt Publishing, 2017. | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | |
| 1 | <https://onlinecourses.swayam2.ac.in/cec21_cs08/preview> | | | | | | | | | |
| 2 | <https://www.tutorialspoint.com/artificial_intelligence/index.htm> | | | | | | | | | |
| 3 | <https://www.coursera.org/learn/introduction-to-ai> | | | | | | | | | |
| 4 | <https://www.udacity.com/course/intro-to-artificial-intelligence--cs271> | | | | | | | | | |
| Course Designed By: **Dr.R.Porkodi** | | | | | | | | | | |

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| **COS** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **L** | **M** | **M** | **L** | **L** | **L** | **M** | **M** |
| CO2 | **S** | S | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **M** |
| CO3 | **S** | **S** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **L** |
| CO4 | **S** | **S** | **M** | M | **M** | **M** | **L** | **L** | **M** | **L** |
| CO5 | **S** | **S** | **M** | **M** | **M** | **L** | **L** | **M** | **M** | **L** |

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| **ourse Code** | | **24DS1E3** | **BUSINESS INTELLIGENCE** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Elective** | **4** | **0** | | **0** | **4** |
| **Pre-Requisite** | | | No pre-requisite | **Syllabus Version** | | | **2024-25** | |
| **Course Objective:** | | | | | | | | |
| The main objectives of this course are:   1. To gain knowledge on business intelligence system, life cycle and techniques used in it. 2. To become familiar with the knowledge delivery and modeling aspects. 3. To learn how to use and apply machine learning models to solve the business problems. | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Understand the concepts of Business Intelligence cycle to take the correct decision at right time. | | | | | K1/K2/K4 | | |
| 2 | Demonstrate various Business knowledge representations and reporting features. | | | | | K2/K3/K4 | | |
| 3 | Identification of good operating practices in business environments. | | | | | K3/K4 | | |
| 4 | Demonstrates the Business Intelligence models in logistics and production domain. | | | | | K3/K4/K5 | | |
| 5 | Communicate technologies going to rule the future of Business Intelligence. | | | | | K3/K4 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | |
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| **Unit:1** | **INTRODUCTION** | | | | | **10 hours** | | |
| Business Intelligence: Effective and timely decisions – Data, information and knowledge – Role of mathematical models – Business intelligence architectures: Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence. | | | | | | | | |
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| **Unit:2** | **BUSINESS INTELLIGENCE KNOWLEDGE DELIVERY** | | | | | **13 hours** | | |
| Knowledge Delivery: The business intelligence user types, Standard reports, Interactive Analysis and Adhoc Querying, Parameterized Reports and Self-Service Reporting, dimensional analysis, Alerts/Notifications, Visualization: Charts, Graphs, Widgets, Scorecards and Dashboards, Geographic Visualization, Integrated Analytics, Considerations: Optimizing the Presentation for the Right Message. | | | | | | | | |
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| **Unit:3** | **ANALYSING EFFICIENCY** | | | | | **12 hours** | | |
| Efficiency: Efficiency measures – The CCR model: Definition of target objectives- Peer groups – Identification of good operating practices; cross efficiency analysis – virtual inputs and outputs – Other models. Pattern matching – cluster analysis, outlier analysis. | | | | | | | | |
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| **Unit:4** | **BUSINESS INTELLIGENCE APPLICATIONS** | | | | | **13 hours** | | |
| Business Intelligence Applications: Marketing models – Logistic and Production models – Case studies. | | | | | | | | |
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| **Unit:5** | **FUTURE OF BUSINESS INTELLIGENCE** | | | | | **12 hours** | | |
| Future of Business Intelligence: Future of business intelligence – Emerging Technologies, Machine Learning, Predicting the Future, BI Search & Text Analytics – Advanced Visualization – Rich Report, Future beyond Technology. | | | | | | | | |
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| **Unit:6** | **Contemporary Issues** | | | | | **2 hours** | | |
| Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops | | | | | | | | |
| **Total Lectures** | | | | | | **62 hours** | | |
| **Text Books** | | | | | | | | |
| 1 | Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 9th Edition, Pearson 2013. | | | | | | | |
| **Reference Books** | | | | | | | | |
| 1 | Larissa T. Moss, S. Atre, “Business Intelligence Roadmap: The Complete Project Lifecycle of Decision Making”, Addison Wesley, | | | | | | | |
| 2 | David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager‟s Guide”, Second Edition, 2012. | | | | | | | |
| 3 | Cindi Howson, “Successful Business Intelligence: Secrets to Making BI a Killer App”, McGraw-Hill, 2007. | | | | | | | |
| 4 | Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2009 | | | | | | | |
|  | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | |
| 1 | <https://www.classcentral.com/course/swayam-business-analytics-for-management-decision-10050> | | | | | | | |
| 2 | <https://www.coursera.org/specializations/business-analytics> | | | | | | | |
| 3 | <https://www.udacity.com/course/business-analytics-nanodegree--nd098> | | | | | | | |
| 4 | <https://www.tutorialspoint.com/business_analysis/business_analysis_quick_guide.htm> | | | | | | | |
| Course Designed By: **Dr.R.Porkodi** | | | | | | | | |

Mapping with programme outcomes:

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| **COS** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **L** | **S** | **M** | **L** | **L** | **L** | **M** | **M** |
| CO2 | **S** | S | **M** | **M** | **M** | **M** | **L** | **M** | **S** | **S** |
| CO3 | **S** | **S** | **M** | **S** | **M** | **M** | **L** | **L** | **M** | **S** |
| CO4 | **S** | **S** | **S** | **S** | **M** | **M** | **L** | **L** | **S** | **S** |
| CO5 | **S** | **L** | **S** | **S** | **M** | **L** | **L** | **M** | **S** | **S** |

S- Strong; M-Medium; L-Low

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| **Course code** | | | | | **24DS2E1** | | **TRANSFORMS AND APPLICATIONS** | **L** | | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | | **ELECTIVE** | **4** | | | | **0** | **0** | **4** |
| **Pre-requisite** | | | | | | | **Basic knowledge in Calculus** | **Syllabus Version** | | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. Acquaint the students some simple concepts like harmonic decomposition, convolution, etc. 2. Introduce some useful transforms, continuous and discrete, to solve equations of the real world. 3. Discuss various properties of the transforms | | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | |
| CO1 | | | Learn the basic concepts of Laplace Transform, Z transform and fourier transform and their properties | | | | | | | | | | K1 | |
| CO2 | | | Select the appropriate method to solve mathematical problems. | | | | | | | | | | K2 | |
| CO2 | | | Apply Laplace transform to differential equations | | | | | | | | | | K3 | |
| CO3 | | | Understand and evaluate partial derivatives and integrals of multivariable functions. | | | | | | | | | | K4 | |
| CO4 | | | Find the Fourier transform, inverse Fourier transform and Residue of a function. | | | | | | | | | | K5 | |
| CO5 | | | Apply Z transform to difference equations | | | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | |
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| **Unit 1** | | | | | | **Laplace Transform** | | | | | **12 hours** | | | |
| The Laplace transform: Definition and notation - transforms of simple functions - existence of Laplace transform- properties of the Laplace transform - table of Laplace transforms - the inverse transform - evaluation of inverse transforms - inversion using first shift theorem - Step and impulse functions: the Heaviside step function - Laplace transform of unit step function - the second shift theorem-inversion using the second shift theorem - Solution of differential equations: transforms of derivatives- transforms of integrals- ordinary differential equations. | | | | | | | | | | | | | | |
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| **Unit 2** | | | | | | **Z Transform** | | | **14 hours** | | | | | |
| The z transform: definition and notation - Properties of the z transform: linearity property - first shift property - second shift property - some further properties -table of z transforms- The inverse z transform: inverse techniques- Discrete-time systems and difference equations: difference equations- the solution of difference equations. | | | | | | | | | | | | | | |
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| **Unit 3** | | | | | | **Fourier Series** | | | | **14 hours** | | | | |
| Fourier series expansion: periodic functions -Fourier’s theorem - functions of period 2\pi - even and odd functions - linearity property - functions of period T - Functions defined on a finite interval: full-range series - half-range cosine and sine series - Complex form for Fourier series: complex representation - the multiplication theorem and Parseval’s theorem. | | | | | | | | | | | | | | |
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| **Unit 4** | | | | | | **Fourier Transform** | | | | **15 hours** | | | | |
| The Fourier transform: the Fourier integral - the Fourier transform pair - continuous Fourier spectra - Properties of the Fourier transform: linearity property- time-differentiation property- time-shift property- frequency-shift property- symmetry property- Transforms of the step and impulse functions: energy and power- convolution. | | | | | | | | | | | | | | |
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| **Unit 5** | | | | **Fourier Transform (continued)** | | | | | | **18 hours** | | | | |
| The Fourier transform in discrete time: a Fourier transform for sequences- the discrete Fourier transform-the fast Fourier transform. | | | | | | | | | | | | | | |
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| **Unit 6** | | | | **Contemporary Issues** | | | | | | **2 hours** | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | |
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|  | | | | **Total Lecture hours** | | | | | | **75 hours** | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | |
| 1 | “Advanced Modern Engineering Mathematics” by **G. James,** Fourth Ed., 2011 Pearson.  Unit I : Chapter 5: Sections 5.2, 5.3 & 5.5 (only first four subsections);  Unit II : Chapter 6: Sections 6.2, 6.3, 6.4& 6.5;  Unit III: Chapter 7: Sections 7.2 (excluding 7.2.9), 7.3, 7.6 (only first two subsections);  Unit IV: Chapter 8: Sections 8.2, 8.3, 8.5;  Unit V : Chapters 6 : Chapter 8: Section 8.6 (excluding 8.6.4) | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | |
| 1 | **L. Debnath& D. Bhatta**, Integral Transforms and their Applications, CRC Press, 2015. | | | | | | | | | | | | | |
| 2 | **E. Kreyszig,** “Advanced Engineering Mathematics” Wiley, 2017. | | | | | | | | | | | | | |
| 3 | **C.R. Wylie & L.C. Barret,** “Advanced Engineering Mathematics”, McGraw Hill, 2013. | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | |
| 1 | | <https://nptel.ac.in/courses/111105035> | | | | | | | | | | | | |
| 2 | | <https://nptel.ac.in/courses/111106046> | | | | | | | | | | | | |
| 3 | | <https://www.youtube.com/watch?v=gZNm7L96pfY> | | | | | | | | | | | | |
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| Course Designed By: **Dr.R.Rakkiyappan and Dr.S.Saravanan** | | | | | | | | | | | | | | |

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| **Course Code** | | | | | **24DS2E2** | **PREDICTIVE ANALYTICS** | **L** | **T** | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | **ELECTIVE** | **4** | **0** | **0** | | **4** |
| **Pre-requisite** | | | | | | Basics of Mathematics and Statistics | **Syllabus Version** | | **2024-25** | | |
| **Course Objectives** | | | | | | | | | | | |
| The main objectives of this course are to:  1. introduce the concept of forecasting  2. develop analytical skill in fitting regression models  3. provide the methodical approach for building time series models  4. impart the knowledge of assessing pattern of time series data plot and measuring the trend  5. understand the concept of Box-Jenkins methodology and its application in forecasting | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | | Identify the time series data patterns | | | | | | | K1-K3 | |
| 2 | | | Forecast future values by selecting the suitable time series models | | | | | | | K4-K5 | |
| 3 | | | Fit a linear regression model | | | | | | | K4-K5 | |
| 4 | | | Measure the linear trend in a time series plot | | | | | | | K3,K5 | |
| 5 | | | Apply Box-Jenkins methodology to identify a suitable time series model | | | | | | | K4-K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | |
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| **Unit 1** | | | | **Forecasting** | | | | | **12 Hours** | | |
| Forecasting: Nature and Uses – Forecasting Process – Time Series Plot – Plotting Smoothed Data Exploring Time Series Data Pattern – Auto-covariance and Auto-correlation Functions – Correlogram – General Approach to Time Series Modeling and Forecasting- Evaluating and Monitoring Forecasting Model Performance. | | | | | | | | | | | |
| **Unit 2** | | | | **Forecasting Methodology** | | | | | **12 hours** | | |
| Forecasting techniques – Measuring Forecast Error – Applications – Moving averages and Smoothing Methods - Naïve Models – Simple and Moving Average Methods – Exponential Smoothing: First Order Exponential Smoothing – Holt - Winter Forecast Methods. | | | | | | | | | | | |
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| **Unit 3** | | | | **Regression Analysis** | | | | | **12 hours** | | |
| Linear Regression Models – Least Squares Estimation – Test for Significance of Regression – Confidence Interval on Regression Coefficients and Mean Response – Prediction of New Observation – Model Adequacy Checking: Residual Plots, Measures of Leverage and Influence – Regression Models for Time Series Data – Autocorrelation and Durbin-Watson Test. | | | | | | | | | | | |
| **Unit 4** | | | | **Time Series Analysis** | | | | | **12 hours** | | |
| Time Series – Components of Time Series: Trend, Seasonal Variation, Cyclical Variation and Irregular Variations – Additive and Multiplicative Models - Methods of Measuring Trend - Linear, Quadratic and Exponential Trends – Logistic Growth Model - Simple problems. | | | | | | | | | | | |
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| **Unit 5** | | | | **Box-Jenkins Methodology** | | | | | **12 hours** | | |
| Stationary and Nonstationary Time Series Data - Box-Jenkins Methodology: Autoregressive, Moving Average, Autoregressive Moving Average, Autoregressive Integrated Moving Average Models - Model Building Strategy - Model Selection Criteria – Diagnostic Checking. | | | | | | | | | | | |
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| **Unit 6** | | | | **Contemporary Issues** | | | | | **2 hours** | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | |
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|  | | | | | **Total Lecture Hours** | | | | **62 hours** | | |
| **Reference Books** | | | | | | | | | | | |
| 1 | Hanke, J. E., and Wichern, D. (2014). Business Forecasting, Ninth Edition, Pearson New International Edition. | | | | | | | | | | |
| 2 | Montgomery, D. C., Jennings, C. L., Kulahci, M. (2015). Introduction to Time Series Analysis and Forecasting, Second Edition, Wiley. | | | | | | | | | | |
| 3 | Box, G.E.P., Jenkins, G.M., Reinsel, G. C., and Ljung, G.M. (2015). Time Series Analysis: Forecasting and Control, Fifth Edition, John-Wiley & Sons, New Jersey | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
| 1 | | https://nptel.ac.in/courses/103106123 | | | | | | | | | |
| 2 | | https://nptel.ac.in/courses/111104098 | | | | | | | | | |
| 3 | | https://onlinecourses.nptel.ac.in/noc21\_ch28/preview | | | | | | | | | |
| 4 | | https://archive.nptel.ac.in/courses/111/104/111104098/ | | | | | | | | | |
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| Course Designed By: Dr. R. Vijayaraghavan / Dr. R. Muthukrishnan | | | | | | | | | | | |

***Note*: This paper is application oriented. The derivation of the formulae and equations is outside the scope of the paper and hence, it may be avoided.**

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| **Course code** | | | | **24DS2E3** | | **SOFTWARE PROJECT MANAGEMENT** | **L** | | | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **ELECTIVE** | **4** | | | | | **0** | **0** | **4** |
| **Pre-requisite** | | | | | | Students should have prior experience and knowledge as members of software development. | **Syllabus Version** | | | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | | | | |
| * To outline the need for Software Project Management * To highlight different techniques for software cost estimation and activity planning. * To define and highlight importance of software project management * To describe the software project management activities * To train software project managers and other individuals involved in software project * To planning and tracking and oversight in the implementation of the software project management process. | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | |
| 1 | | | Understand the practices and methods for successful software project management | | | | | | | | K2/ K3 | | | |
| 2 | | | Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project | | | | | | | | K1/K3 | | | |
| 3 | | | Identify techniques for requirements, policies and decision making for effective resource management | | | | | | | | K4/ K5 | | | |
| 4 | | | Compare and differentiate organization structures and project structures | | | | | | | | K3/ K5 | | | |
| 5 | | | Devise a framework for software project management plan for activities, risk, monitoring and control | | | | | | | | K6/ K4 | | | |
| 6 | | | Devise a framework to manage people | | | | | | | | K6/ K3 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | |
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| **Unit 1** | | | | | **Introduction to Software Project Management** | | | | | **10 hours** | | | | |
| What is Software Project Management – Categorization of Software Projects- Project management skills- The role and responsibility of a software project manager- How to manage a software project successfully?- Project Plan - Project management steps and Principles – The scenario in a software project- Roles & Responsibilities- Gantt chart- Pert chart- The project management process: the phases- Deal with uncertainties in software development- The customers role in software development projects. | | | | | | | | | | | | | | |
| **Unit 2** | | | | | **Software Development Models & Risk Assessment** | | | | | | | **12 hours** | | |
| General- Software Development Life Cycle (SDLC)- What are the Software Development Life Cycle (SDLC) phases? - Waterfall model- V Model-Incremental model-RAD model- Agile model-Iterative model- Spiral model- Prototype model -Constructive Cost Model (COCOMO)-Introduction -Software Risk Identification-Software Risk Analysis-Software Risk Planning-Software Risk Monitoring-Contingency Plans-Presentation of the typical risk report. | | | | | | | | | | | | | | |
| **Unit 3** | | | | | **Activity planning** | | | | **12 hours** | | | | | |
| Objectives of Activity Planning - Project Schedules - Sequencing and Scheduling Activities - Network Planning Models- Forward Pass – Backward Pass- Identifying critical path- Activity on Arrow Networks- Risk Management- Nature of Risk- Categories of Risk- A framework for dealing with Risk- Risk Identification- Risk analysis and prioritization- Risk planning and Risk monitoring. | | | | | | | | | | | | | | |
| **Unit 4** | | | | | **Monitoring and Managing People** | | | | **12 hours** | | | | | |
| Creating the Framework - Collecting the Data – Review- Project Termination Review- Visualizing Progress- Cost Monitoring- Earned Value Analysis- Prioritizing Monitoring- Getting Project Back to Target- Change Control- Software Configuration Management Introduction to managing people- Understanding Behavior- Organizational Behavior: A Background- Selecting the Right Person for the Job- The Oldham –Hackman Job Characteristics Model- Stress – Decision Making- Leadership. | | | | | | | | | | | | | | |
| **Unit 5** | | | | | **Project Leadership and Closure of a Project** | | | **12 hours** | | | | | | |
| Introduction - Project Leadership- Modern approaches- Styles of leadership – Introduction to Closure of a Project - Project implementation - Administrative closure - Project Evaluation. | | | | | | | | | | | | | | |
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| **Unit 6** | | | | | **Contemporary Issues** | | | **2 hours** | | | | | | |
| Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | | **60 hours** | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | |
| 1 | Software Project Management , Hughes , ‎ McGraw Hill Education; 5th edition (1 July  2017) | | | | | | | | | | | | | |
| 2 | Bob Hughes, Mike Cotterell, Rajib Mall, “Software Project Management”, Fifth Edition,  Tata McGraw Hill, 2011. | | | | | | | | | | | | | |
| 3 | Introduction to Software Project Management, Adolfo Villafiorita, Auerbach Publications, 2014 | | | | | | | | | | | | | |
| 4 | Effective Software Project Management, Robert K. Wysocki, Willey ,March 2006 | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | |
| 1 | JackMarchewka,” Information Technology-Project Management”, Wiley Student Version, 4th Edition, 2013. | | | | | | | | | | | | | |
| 2 | James P Lewis,”Project Planning, Scheduling & Control”, McGraw Hill, 5th Edition, 2011. | | | | | | | | | | | | | |
| 3 | PankajJalote,” Software Project Management in Practise”, Pearson Education, 2002 | | | | | | | | | | | | | |
| 4 | Samuel J mantel et.el, Project Management Core Textbook, Wiley India. | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | |
| 1 | | https://nptel.ac.in/courses/106105218 | | | | | | | | | | | | |
| 2 | | https://onlinecourses.swayam2.ac.in/cec20\_cs07/preview | | | | | | | | | | | | |
| 3 | | https://www.classcentral.com/course/swayam-project-management-7912 | | | | | | | | | | | | |
| Course Designed By: **Dr. D.NAPOLEON** | | | | | | | | | | | | | | |

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|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | **S** | **S** | **S** | **S** | **M** | **S** | **S** | **M** | **S** | **S** |
| **CO2** | **M** | **S** | **L** | **S** | **S** | **M** | **M** | **S** | **M** | **M** |
| **CO3** | **M** | **M** | **M** | **S** | **M** | **S** | **S** | **S** | **S** | **L** |
| **CO4** | **S** | **S** | **L** | **M** | **S** | **L** | **L** | **L** | **S** | **S** |
| **CO5** | **M** | **M** | **S** | **L** | **M** | **M** | **L** | **S** | **L** | **M** |

**S- Strong; M-Medium; L-Low**

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| **Course Code** | | **24DS3E1** | **NATURAL LANGUAGE PROCESSING** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **ELECTIVE** | **4** | **0** | | **0** | **4** |
| **Pre-Requisite** | | | Fundamentals of finite automata, regular expressions and grammar structures. | **Syllabus Version** | | | **2024-25** | |
| **Course Objective:** | | | | | | | | |
| The main objectives of this course are:   1. To understand algorithms for the processing of linguistic information and computational properties of natural languages. 2. To conceive basic knowledge on various morphological, syntactic and semantic NLP tasks. 3. To familiarize various NLP software libraries and data sets publicly available. 4. To develop systems for various NLP problems with moderate complexity. 5. To learn steps for creating Machine learning models. | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Describe the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language. | | | | | K1/K2 | | |
| 2 | Demonstrate understanding of the relationship between NLP and statistics & machine learning. | | | | | K2/K4 | | |
| 3 | Discover various linguistic and statistical features relevant to the basic NLP task, namely, spelling correction, morphological analysis, parts-of-speech tagging and syntactic parsing. | | | | | K2/K4 | | |
| 4 | Demonstrate the concept of semantic analysis and word sense disambiguation. | | | | | K2/K4 | | |
| 5 | Understand the components of machine translation process and develop the model for NLP applications. | | | | | K2/K3/K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | |
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| **Unit:1** | **INTRODUCTION** | | | | | **10** | | |
| Introduction - NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field - N-gram Language Models - The role of language models. Simple N- gram models. Estimating parameters and smoothing. Evaluating language models. | | | | | | | | |
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| **Unit:2** | **BASIC NLP TECHNIQUES** | | | | | **12** | | |
| Part Of Speech Tagging and Sequence Labeling - Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training) - Basic Neural Networks. Any basic introduction to perceptron and backpropagation | | | | | | | | |
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| **Unit:3** | **PARSING** | | | | | **13** | | |
| LSTM Recurrent Neural Networks -Syntactic parsing - Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs. Neural shift-reduce dependency parsing | | | | | | | | |
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| **Unit:4** | **SEMANTIC ANALYSIS** | | | | | **12** | | |
| Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labelling and Semantic Parsing | | | | | | | | |
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| **Unit:5** | **MACHINE TRANSLATION** | | | | | **13** | | |
| Information Extraction (IE) - Named entity recognition and relation extraction. IE using sequence labelling. -Machine Translation (MT) Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars. | | | | | | | | |
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| Unit:6 | **Contemporary Issues** | | | | | **2** | | |
| Discussion on case study - Expert lectures - Online seminars – Webinars – Workshops | | | | | | | | |
| **Total Lectures** | | | | | | **62** | | |
| **Text Books** | | | | | | | | |
| 1 | Jurafsky Dan and Martin James H. “Speech and Language Processing” ,3rd Edition, 2018. | | | | | | | |
| **Reference Books** | | | | | | | | |
| 1 | Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana, Practical Natural Language Processing, 2020. | | | | | | | |
| 2 | Steven Bird, Ewan Klein, Edward Loper., Natural Language Processing with Python, 2009. | | | | | | | |
|  | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | |
| 1 | <https://onlinecourses.nptel.ac.in/noc19_cs56/preview> | | | | | | | |
| 2 | <https://www.edx.org/learn/natural-language-processing> | | | | | | | |
| 3 | <https://www.coursera.org/specializations/natural-language-processing> | | | | | | | |
| 4 | <https://www.tutorialspoint.com/natural_language_processing/index.htm> | | | | | | | |
| Course Designed By:**Dr.R.Porkodi** | | | | | | | | |

Mapping with programme outcomes:

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| **COS** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **L** | **M** | **M** | **L** | **L** | **L** | **M** | **S** |
| CO2 | **S** | S | **M** | **M** | **M** | **M** | **M** | **L** | **M** | **S** |
| CO3 | **S** | **S** | **M** | **M** | **M** | **M** | **M** | **L** | **M** | **S** |
| CO4 | **S** | **S** | **M** | **M** | **M** | **M** | **M** | **L** | **M** | **S** |
| CO5 | **S** | **S** | **M** | **L** | **M** | **L** | **M** | **L** | **S** | **S** |

S- Strong; M-Medium; L-Low

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| **Course Code** | | | **24DS3E2** | **SOCIAL MEDIA ANALYTICS** | | **L** | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **ELECTIVE** | | 4 | | 0 | | 0 | 4 |
| **Pre-requisite** | | | | Foundations of Data Science  Big data framework | | **Syllabus Version** | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are:   1. To provide an overview of common text mining and social media data analytic activities. 2. To understand the complexities of processing text and network data from different data sources. 3. To enable students to solve complex real-world problems for recommendation systems. 4. To enable the learners to develop skills required for analyzing the effectiveness of social media for business purposes. 5. To familiarize the learners with the concept of social media analytics and understand its significance. 6. To familiarize the learners with the tools of social media analytics. | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | Understand the terminologies, metaphors and perspectives of social media analytics | | | | | | | K1/K2 | | |
| 2 | | Apply a wide range of classification, clustering, estimation and prediction algorithms on Textual data. | | | | | | | K3/K4 | | |
| 3 | | Perform social network analysis to identify important social actors, subgroups and network properties in social media sites. | | | | | | | K2/K4 | | |
| 4 | | Apply state of the art web mining tools and libraries on realistic data sets as a basis for business decisions and applications. | | | | | | | K2/K3/K4 | | |
| 5 | | Provide solutions to the emerging problems with social media such as behavior analytics and Recommendation systems | | | | | | | K2/K3/K4 | | |
| 6 | | Design new ontology-based solutions for opinion extraction, sentiment classification and data summarization problems. | | | | | | | K2/K3/K4/K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | |
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| **Unit:1** | | | **Foundation for Social Media Analytics** | | | | **7 hours** | | | | |
| Foundation for Analytics: – Digital Gap – Social Media Data Sources – Defining Social Media Data –Data Sources – Estimated vs. Factual Data Sources – Data Gathering in Social Media Analytics. From Data to Insights: Actionable Analytics – Focus on objective – Plan to shape data to insights –Choosing a good analytics tool – Data Aggregation calculations and display – Data display – Social-Media and Big data – Potential Challenges. Data Identification: Professional networking sites - social sites – information sharing sites – micro blogging sites – blogs /wikis. | | | | | | | | | | | |
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| **Unit:2** | | | **Social Media Analytics Types, Tools and Social Network Landscape** | | | | **8 hours** | | | | |
| Analytics in social media: Types of analytics. Dedicated Vs. Hybrid Tools – Dedicated tools – Hybrid tools – Data Integration Tools – Best Setup. Social Network Landscape: Concept and UX on social networks – Interactivity of social network –Content flow on social network – Interaction Pattern between users – Social-Media as a two-way channel. | | | | | | | | | | | |
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| **Unit:3** | | | **Analytic Process and Metrics** | | | **10 hours** | | | | | |
| Analytics Process: Analysis – Insight – Investigation beyond social analytics – Shaping a method –analysis cycle – Community Activity – Resources – Attention span – Dynamic cycles – Short Periods –Long Periods – Analyst Mindset – Instinctive Analyst. Metrics: Introduction – Default and custom metrics – Metrics Categories – Graph Types – Metric Capabilities – Metrics and Strategy – Estimated Metrics – Metrics and Tactics. | | | | | | | | | | | |
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| **Unit:4** | | | **Semantic Web and Social Network Analysis** | | | **9 hours** | | | | | |
| Introduction to Semantic Web: Limitations of current Web, Development of Semantic Web, Emergence of the Social Web. Social Network analysis: Development of Social Network Analysis -Key concepts and measures in network analysis. Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks. | | | | | | | | | | | |
| **Unit:5** | | | **Semantic Web and Ontology** | | | **11 hours** | | | | | |
| Knowledge representation on the Semantic web: Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language. | | | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | **2 hours** | | | | | | | |
| Online Courses, Webinars and Case studies | | | | | | | | | | | | |
|  | | | **Total Lecture hours** | | **60 hours** | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | |
| 1 | Alex Goncalves, “Social Media Analytics Strategy - Using Data to Optimize Business Performance”, Alex Goncalves, APress 2017. | | | | | | | | | | | |
| 2 | Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007. | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | |
| 1 | Ganis, Kohirkar (2016). Social media Analytics, IBM Press PTG, 1st Edition. | | | | | | | | | | | |
| 2 | Nancy Flynn (2012). The Social Media Hand book Policies, and Best Practices, Wiley. | | | | | | | | | | | |
| 3 | Guandong Xu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking –Techniques and applications”, First Edition Springer, 2011. | | | | | | | | | | | |
| 4 | Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008. | | | | | | | | | | | |
|  | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | |
| 1 | https://www.coursera.org/learn/social-media-data-analytics | | | | | | | | | | | |
| 2 | https://www.classcentral.com/course/social-media-analytics-introduction-6916 | | | | | | | | | | | |
| 3 | https://und.edu/academics/online/enroll-anytime/comm499.html | | | | | | | | | | | |
| Course Designed By: Dr. P.B.Pankajavalli | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | S | S | M | L | L | M | M | M |
| **CO2** | S | S | S | S | M | L | M | M | S | S |
| **CO3** | S | S | S | S | S | M | M | M | S | S |
| **CO4** | S | S | S | S | S | M | M | M | S | S |
| **CO5** | S | S | S | S | M | M | M | S | S | S |
| **CO6** | S | S | S | S | S | M | M | S | S | S |

\*S-Strong; M-Medium; L-Low

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| **Course Code** | | **24DS3E3** | **HEALTHCARE ANALYTICS** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **ELECTIVE** | **4** | **0** | | **0** | **4** |
| **Pre-Requisite** | | | Fundamentals of Data mining | **Syllabus Version** | | | **2024-25** | |
| **Course Objective:** | | | | | | | | |
| The main objectives of this course are:   1. To understand the various formats of electronic health care information and its challenges. 2. To learn depth knowledge on the techniques used to analyse health care data. 3. To understand the various analytical methods on processing healthcare data and privacy preservation of health care data. | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Understand the different formats of healthcare data, resources and its challenges while processing it. | | | | | K1/K2 | | |
| 2 | Analysis of healthcare data from various data sources like imaging, sensing, signalling and genomic data. | | | | | K2/K3/K4 | | |
| 3 | Apply analytics in natural language clinical text, biomedical literature and social media text for decision making in healthcare services. | | | | | K3/K5 | | |
| 4 | Apply clinical predictive models to healthcare data to provide health outcomes in relevant populations of interest. | | | | | K3/K4 | | |
| 5 | Understand and apply the relevant data analytic models to build decision support systems for healthcare domain. | | | | | K3/K4/K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | |
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| **Unit:1** | **INTRODUCTION TO HEALTHCARE ANALYSIS** | | | | | **10** | | |
| Introduction to Healthcare Data Analytics- Applications and practical systems for Healthcare – Resources for healthcare data analytics - Electronic Health Records - Components of HER - Coding Systems - Benefits of EHR- Barrier to Adopting HER Challenges- Phenotyping Algorithms. | | | | | | | | |
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| **Unit:2** | **HEALTHCARE DATA SOURCES AND ANALYSIS** | | | | | **12** | | |
| Biomedical Image Analysis: Imaging Modalities – Object detection – Segmentation - Mining of Sensor Data in Healthcare: Challenges – Sensor data mining applications – Nonclinical healthcare applications – Biomedical Signal Analysis- Genomic Data Analysis for Personalized Medicine – Types of computational genomics. | | | | | | | | |
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| **Unit:3** | **HEALTH CARE ANALYTICS** | | | | | **13** | | |
| Natural Language Processing and Data Mining for Clinical Text- Challenges in processing in clinical reports – Clinical applications - Mining the Biomedical literature – Named entity recognition and extraction - Social Media Analytics for Healthcare – analytics on public health research. | | | | | | | | |
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| **Unit:4** | **ADVANCED DATA ANALYTICS ON HEALTHCARE** | | | | | **13** | | |
| Advanced Data Analytics for Healthcare: Review of Clinical Prediction Models- Temporal Data Mining for Healthcare Data- Visual Analytics for Healthcare- Predictive Models for Integrating Clinical and Genomic Data- Information Retrieval for Healthcare- Privacy-Preserving Data Publishing Methods in Healthcare. | | | | | | | | |
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| **Unit:5** | **CASE STUDIES: HEALTHCARE APPLICATIONS** | | | | | **12** | | |
| Applications: Applications and Practical Systems for Healthcare– Data Analytics for Pervasive Health- Fraud Detection in Healthcare- Data Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems- Computer-Assisted Medical Image Analysis Systems- Mobile Imaging and Analytics for Biomedical Data. | | | | | | | | |
|  | | | | | | | | |
| **Total Lectures** | | | | | | **60** | | |
| **Text Books** | | | | | | | | |
| 1 | Chandan K.Reddy, Charu C. Aggarwal, “Health Care data Analysis”, First edition, CRC, 2015. | | | | | | | |
| 2 | Vikas Kumar, “Health Care Analysis Made Simple”, Packt Publishing, 2018. | | | | | | | |
| **Reference Books** | | | | | | | | |
| 1 | Nilanjan Dey, Amira Ashour, 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. | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | |
| 1 | <https://www.coursera.org/courses?query=healthcare%20analytics> | | | | | | | |
| 2 | <https://onlinecourses.nptel.ac.in/noc22_hs40/preview> | | | | | | | |
| 3 | <https://www.udacity.com/course/health-informatics-in-the-cloud--ud809> | | | | | | | |
| Course Designed By: **Dr.R.Porkodi** | | | | | | | | |

Mapping with programme outcomes:

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| **COS** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **L** | **S** | **M** | **L** | **L** | **L** | **M** | **M** |
| CO2 | **S** | S | **M** | **M** | **M** | **M** | **L** | **M** | **S** | **S** |
| CO3 | **S** | **S** | **M** | **S** | **M** | **M** | **L** | **L** | **M** | **S** |
| CO4 | **S** | **S** | **S** | **S** | **M** | **M** | **L** | **L** | **S** | **S** |
| CO5 | **S** | **S** | **S** | **S** | **M** | **L** | **L** | **M** | **S** | **S** |

S- Strong; M-Medium; L-Low

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| **Course code** | | | | **24DS3E4** | | **NATURE INSPIRED COMPUTING** | **L** | | **T** | **P** | **C** | |
| **Core/Elective/Supportive** | | | | | | **ELECTIVE** | **4** | | **0** | **0** | **4** | |
| **Pre-requisite** | | | | | | Familiarity with programming language such as C / C++ / Java / Matlab / Python with knowledge of basic optimization methods | **Syllabus Version** | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are to:   1. Inculcate knowledge of Nature Inspired Computing Techniques and their working principle. 2. Identify the suitable Nature Inspired Computing Techniques to solve a problem. 3. Generate the possible ways of solution to a certain real world problem using Nature Inspired Computing Techniques 4. Analyze and modify the performance of the Nature Inspired Computing algorithms. | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | | Identify the Nature Inspired Computing Techniques and their classifications. | | | | | K2/K3 | | | |
| 2 | | | Understating evolutionary theory to develop Nature Inspired algorithms | | | | | K2 | | | |
| 3 | | | Design and develop Nature Inspired algorithms | | | | | K2/K3 | | | |
| 4 | | | Apply swarm intelligence to practical problems. | | | | | K2/K3 | | | |
| 5 | | | Understand immune algorithms | | | | | K2 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Unit:1** | | | | | **Introduction to Nature Inspired Computing** | | **10 hours** | | | | |
| Computation Inspired by Nature- Evolution Versus Learning-, Swarm Intelligence-Group Behaviors- Foraging Theory- Heuristics, Metaheuristics, and Hyper-Heuristics- Stochastic algorithms-Searching -Random search-Stochastic Hill Climbing-iterated Local search- Variable Neighborhood search- Greedy Randomized Adaptive search- Tabu search | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Unit:2** | | | | | **Evolutionary Algorithms** | | **12 hours** | | | | |
| Introduction to Evolutionary Computation -Evolutionary Algorithms Versus Simulated Annealing- Terminology- Encoding/Decoding- Selection/Reproduction - Crossover- Mutation - Noncanonical Genetic Operators -Exploitation Versus Exploration-Genetic Algorithms for Sequence Optimization | | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Unit:3** | | | | | **Physical and Probabilistic Algorithm** | | **12 hours** | | | | |
| Simulated Annealing- External optimization- Harmony search – Cultural algorithm- Memetic Algorithm- Population based Incremental Learning- Compact Genetic Algorithm- Bayesian Optimization Algorithm | | | | | | | | | | | |
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| **Unit:4** | | | | | **Swarm Algorithms** | | **12 hours** | | | | |
| Particle swarm Optimization- Ant System- Ant Colony Systems – Bees Algorithm- Bacterial Foraging Optimization Algorithm | | | | | | | | | | | |
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| **Unit:5** | | | | | **Immune Algorithms** | | **12 hours** | | | | |
| Introduction- Immune Theories- Immune Algorithms-Clonal Selection Algorithm-Negative selection algorithm- Artificial immune Recognition system- Immune network Algorithm- Dendritic Cell Algorithm | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | |
|  | | | | | | | | | | | |
|  | | | | | **Total Lecture hours** | | **60 hours** | | | | |
| **Text Book(s)** | | | | | | | | | | | |
| 1 | Ke-Lin Du and M.N. S. Swamy, Search and Optimization Metaheuristics- Techniques and Algorithms Inspired by Nature, Springer, Birkhauser, 2016 | | | | | | | | | | |
| 2 | Jason Brownlee, Clever Algorithms- Nature Inspired Programming Recipes, LuLu, 2011 | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | |
| 1 | Xin-She Yang, Nature-Inspired Optimization Algorithms, Elsevier, 2014, ISBN 9780124167438. 2. Introduction to Nature-Inspired Optimization, Editor(s): George Lindfield, John Penny, Academic Press, 2017, ISBN 9780128036365. | | | | | | | | | | |
|  | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
| 1 | | https://www.tutorialspoint.com/ebook/natural\_computing\_with\_python/index.asp | | | | | | | | | |
| 2 | | https://www.tutorialspoint.com/genetic\_algorithms/genetic\_algorithms\_quick\_guide.htm | | | | | | | | | |
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| **Course Designed By: Dr. K. Geetha** | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **S** | **M** | **S** | **M** | L | L | **M** | **S** |
| CO3 | **S** | **S** | **S** | **M** | **S** | **M** | L | L | **M** | **S** |
| CO3 | **S** | **S** | **S** | **M** | **S** | **M** | L | L | **M** | **S** |
| CO4 | **S** | **S** | **S** | **M** | **S** | **M** | L | L | **M** | **S** |
| CO5 | **S** | **S** | **S** | **M** | **S** | **M** | L | L | **M** | **S** |

**\*S-Strong; M-Medium; L-Low**

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| **Course code** | | | | 24DS3E5 | | **CLOUD SECURITY** | | | **L** | | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **ELECTIVE** | | | **4** | | | |  | **0** | **4** |
| **Pre-requisite** | | | | | | Basic knowledge of could environment | | | **Syllabus Version** | | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | | | | | |
| The main objectives of this course are to: | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | |
| 1 | | | To understand fundamental of cloud and its architecture | | | | | | | | | K1/K2 | | | |
| 2 | | | To know about security fundamentals and its issues in cloud environment | | | | | | | | | K1/K2/K4 | | | |
| 3 | | | To familiar with security challenges and security architecture | | | | | | | | | K2/K3/K4 | | | |
| 4 | | | To understand about life cycle issues in cloud environment | | | | | | | | | K1/K2 | | | |
| 5 | | | To know about standards available in cloud computing for security | | | | | | | | | K2/K3 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Cloud computing Fundamentals** | | | | | | **8-- hours** | | | | |
| Fundamentals -Essential Characteristics - Architectural Influences - High-Performance Computing - Utility and Enterprise Grid Computing - Autonomic Computing - Service Consolidation - Horizontal Scaling - Web Services - High-Scalability Architecture - Technological Influences - Universal Connectivity - Commoditization - Excess Capacity - Open-Source Software - Virtualization - Operational Influence- .Cloud Computing Architecture | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Cloud Computing Software Security Fundamentals snd Risk Issues** | | | | | **12-- hours** | | | | | |
| Cloud information security objectives- CIA- security services- Cloud security design principles-Cloud software Testing- Cloud Computing Risk Issues - The CIA Triad - Privacy and Compliance Risks - - Threats to Infrastructure, Data, and Access Control - Common Threats and Vulnerabilities- Cloud access Control Issues- Cloud Service Provider Risks | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Cloud Computing Security Challenges and Security Architectures** | | | **10-- hours** | | | | | | | |
| Cloud Computing Security Challenges - Security Policy Implementation - Policy Types – Computer Security Incident Response Team- Virtualization Security Management - Virtual Threats - VM Security Recommendations - VM-Specific Security Techniques- Security Architecture – Architectural Consideration – Identify Management and access control- Autonomic Security. Security Awareness, Training, and Education - Secure Execution Environment. | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **Life Cycle Issues** | | | **12-- hours** | | | | | | | |
| The Distributed Management Task Force – ISO- The Organization for the Advancement of Structured Information Standards - Storage Networking Industry Association- Open Grid Forum - The Open Web Application Security Project - Incident Response - Internet Engineering Task Force Incident-Handling Guidelines - Layered Security and IDS – Computer Security and incident response teams - Security Incident Notification Process - Automated Notice and Recovery Mechanisms - Encryption and Key Management – Hardware and Software-Based Protection - - VM Life Cycle | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Common Standards in Cloud Computing** | | **12-- hours** | | | | | | | | |
| The Open Cloud Consortium - The Distributed Management Task Force - Standards for Application Developers-Standards for Messaging - Simple Message Transfer Protocol - Post Office Protocol - Internet Messaging Access - Protocol - Syndication - Communications - Standards for Security - Security –SAML, OAuth, OpenID, SSL, TLS. | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| **Expert lectures, online seminars - webinars** | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **56-- hours** | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | |
| 1 | Cloud Security- A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz Russell Dean Vines, Wiley Publishing, Inc, 2010 | | | | | | | | | | | | | | |
| 2 | Cloud Computing-Implementation, Management, and Security, John W. Rittinghouse James F. Ransome, CRC Press, 2010 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | |
| 1 | Secure Cloud Computing, Sushil Jajodia • Krishna Kant Pierangela Samarati • Anoop Singhal Vipin Swarup • Cliff Wang, Springer, | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | |
| 1 | | https://www.tutorialspoint.com/cloud\_computing/cloud\_computing\_challenges.htm | | | | | | | | | | | | | |
| 2 | | https://www.tutorialspoint.com/cloud\_security\_with\_aws\_and\_microsoft\_azure/index.asp | | | | | | | | | | | | | |
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| Course Designed By: Dr. K. Geetha | | | | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **L** | **S** | **M** | **L** | **L** | **L** | **M** | **M** |
| CO3 | **S** | S | **M** | **M** | **M** | **M** | **L** | **M** | **S** | **S** |
| CO3 | **S** | **S** | **M** | **S** | **M** | **M** | **L** | **L** | **M** | **S** |
| CO4 | **S** | **S** | **S** | **S** | **M** | **M** | **L** | **L** | **S** | **S** |
| CO5 | **S** | **S** | **S** | **S** | **M** | **L** | **L** | **M** | **S** | **S** |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | | **24DS3E6** | | **SENTIMENT ANALYSIS** | | **L** | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **ELECTIVE** | | **4** | | | **0** | **0** | **4** |
| **Pre-requisite** | | | | | | Knowledge on social media and good analytical skills | | **Syllabus**  **Version** | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | | | |
| The main objectives of this course are to:  1. Understand the problems of sentiment analysis  2. Understand the sentiment classification of documents  3. Understand the extraction of entities  4. Detect the fake or deceptive opinions | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | |
| 1 | Understand the concepts on sentiment analysis and apply for different problems | | | | | | | | | | | K2/K3 | |
| 2 | Design and apply supervised sentiment classification | | | | | | | | | | | K1/K3 | |
| 3 | Understand and evaluate different approaches for aspect and entity extraction | | | | | | | | | | | K2/K5 | |
| 4 | Design and create sentiment analysis applications | | | | | | | | | | | K6 | |
| 5 | Analyze the fake or deceptive opinions and discovering abnormal patterns | | | | | | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | |
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| **Unit:1** | | | | **INTRODUCTION** | | | | **9 hours** | | | | | |
| Introduction to Sentiment Analysis – Applications – Sentiment Analysis Research – The Problem of Sentiment Analysis – Opinion – Opinion Summary – Affect, Emotion and Mood – Different types of opinions | | | | | | | | | | | | | |
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| **Unit:2** | | | | **SENTIMENT CLASSIFICATION** | | | | **12 hours** | | | | | |
| Document Sentiment Classification – Supervised Sentiment Classification – Unsupervised Sentiment Classification – Sentiment Rating Prediction – Cross-Domain Sentiment Classification – Cross-language Sentiment Classification – Emotion Classification of Documents – Sentence Subjectivity and Sentiment Classification. | | | | | | | | | | | | | |
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| **Unit:3** | | | | **ASPECT SENTIMENT CLASSIFICATION** | | | | | | **12 hours** | | | |
| Aspect Sentiment Classification -Supervised Learning – Lexicon Based Approach - Rules of Sentiment Composition – Negation and Sentiment. | | | | | | | | | | | | | |
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| **Unit:4** | | | | **ASPECT AND ENTITY EXTRACTION** | | | | | | **12 hours** | | | |
| Frequency Based Aspect Extraction – Exploiting Syntactic Relations – Using Supervised Learning – Mapping Implicit Aspects – Grouping Aspects into categories – Exploiting Topic Models – Entity Extraction and Resolution – Opinion Holder and Time Extraction - Sentiment Lexicon Generation – Dictionary-Based Approach – Corpus Based Approach | | | | | | | | | | | | | |
| **Unit:5** | | | | | **FAKE DETECTION** | | | | **13 hours** | | | | |
| Detecting Fake or Deceptive Opinions – Spam types – Supervised Fake Review Detection – Supervised Yelp Data Experiment – Automated Discovery of Abnormal Patterns – Model Based Behavioral Analysis – Group Spam Detection – Identifying Reviewers with Multiple User IDs -Quality of Reviews. | | | | | | | | | | | | | |
| **Unit:6** | | | **Contemporary Issues** | | | | **2 hours** | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | |
| **Total Lecture hours** | | | | | | | **60 hours** | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | |
| 1 | | Bing Liu, Sentiment Analysis: Mining Opinions, Sentiments, and Emotions, 2nd Edition, Cambridge University Press, December 2020. | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | |
| 1 | | Bing Liu, “Sentiment Analysis and Opinion Mining”, Morgan and Claypool publishers, 2012. | | | | | | | | | | | |
| 2 | | Bo Pang and Lillian Lee, “Opinion Mining and Sentiment Analysis”, Now Publishers Inc,2008. | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | |
| 1 | | https://www.udemy.com/course/r-social-media-mining-scraping-with-twitter/?gclid=Cj0KCQjw3v6SBhCsARIsACyrRAk2uLHSInHXsHsDdkMrKgaef\_p7cGhaftEPLJTpav8tiB4pzLTN-koaAkKFEALw\_wcB&matchtype=b&utm\_campaign=LongTail\_la.EN\_cc.INDIA&utm\_content=deal4584&utm\_medium=udemyads&utm\_source=adwords&utm\_term=\_.\_ag\_77882235303\_.\_ad\_533195992030\_.\_kw\_%2Bsentiment+%2Banalysis+%2Bclass\_.\_de\_c\_.\_dm\_\_.\_pl\_\_.\_ti\_kwd-702523984287\_.\_li\_1007810\_.\_pd\_\_.\_ | | | | | | | | | | | |
| 2 | | <https://www.coursera.org/lecture/text-mining/5-6-opinion-mining-and-sentiment-analysis-sentiment-classification-9zE5i> | | | | | | | | | | | |
| Course Designed By: **Dr.D.RAMYACHITRA** | | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | S | S | L | M | M | L | L | L | M | S |
| **CO2** | S | S | S | M | S | M | M | L | L | S |
| **CO3** | S | S | M | S | M | L | L | M | L | S |
| **CO4** | S | S | S | M | S | L | M | M | L | S |
| **CO5** | S | S | S | S | S | M | L | L | M | S |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | | **24DS3E7** | | **TEXT ANALYTICS** | | | | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **ELECTIVE** | | | | **4** |  | | **0** | **4** |
| **Pre-requisite** | | | | | | Familiarity of programming with basic mathematical foundation and language structures | | | | **Syllabus Version** | | **2024-25** | | |
| **Course Objectives:** | | | | | | | | | | | | | | |
| The main objectives of this course are to:   * Enhance student knowledge in Text analytics concepts and applications * To make them familiar about fundamental of Information retrieval and natural language processing * To make them understand about the framework of Text analytics * To inculcate theoretical techniques and applications in text analytics | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | |
| 1 | | | Understand the basics of text analysis | | | | K2 | | | | | | | |
| 2 | | | Will be able to analyze the text parts | | | | K2/K3 | | | | | | | |
| 3 | | | Will be able to analyze the text and to classify them into categories | | | | K2/K3/K4 | | | | | | | |
| 4 | | | Familiar about similarity measure and to cluster texts. | | | | K2/K3/K4/K5 | | | | | | | |
| 5 | | | Know about semantic and sentiment analysis | | | | K2/K3 | | | | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Unit:1** | | | | | INTRODUCTION | | | | | **8-- hours** | | | | |
| Introduction to Text Analytics - Introduction: Text Analytics: What Is It? - Origins and Timeline of Text Analytics - Text Analytics in Business and Industry - Text Analytics Skills - Benefits of Text Analytics - Text Analytics Process Road Map - Fundamental of content analysis – Deductive Vs Inductive Approaches- Unitizing and the unit of Analysis- Sampling. | | | | | | | | | | | | | | |
| **Unit:2** | | | | | PROCESSING AND UNDERSTANDING TEXT | | | | **12-- hours** | | | | | |
| Text Tokenization - Sentence Tokenization - Word Tokenization - Text Normalization - Cleaning Text -Tokenizing Text - Removing Special Characters - Expanding Contractions - Case Conversions - Removing Stopwords - Correcting Words - Stemming - Lemmatization - Understanding Text Syntax and Structure - Installing Necessary Dependencies - Important Machine Learning Concepts - Parts of Speech (POS) Tagging - Shallow Parsing - Dependency-based Parsing. | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | TEXT CLASSIFICATION AND SUMMARIZATION | | **12-- hours** | | | | | | | |
| Introduction about Text Classification - automated Text classification- blue print- Text Normalization - Feature Extraction- Automated Text Classification - Text Summarization - Text Summarization and Information Extraction-concepts-topic modeling-automated Document Summarization | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | TEXT SIMILARITY AND CLUSTERING | | **12-- hours** | | | | | | | |
| Concepts --Text Normalization -Feature Extraction -Text Similarity - Analyzing Term Similarity- Analyzing-Document Similarity - Cosine Similarity - Document Clustering- cluster analysis - Hierarchical Cluster Analysis - K-Means Clustering - Cluster Analysis: Model Fit and Decision-Making. | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | SEMANTIC AND SENTIMENT ANALYSIS | | | **12-- hours** | | | | | | |
| Semantic Analysis -Exploring WordNet -Understanding Synsets - Analyzing Lexical Semantic Relations - Word Sense Disambiguation - Named Entity Recognition - Analyzing Semantic Representations - Propositional Logic - First Order Logic - Sentiment Analysis - Sentiment Analysis of IMDb Movie Reviews - Setting Up Dependencies - Preparing Datasets --Supervised Machine Learning Technique - Unsupervised Lexicon-based Techniques - Comparing Model Performances. | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | | **2 hours** | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | | **58-- hours** | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | |
| 1 | Text Analytics with Python- A Practical real- Worls Approach to Gaining Actionable Insights from your data, Dipanjan Sarkar,Apress, 2016 | | | | | | | | | | | | | |
| 2 | Practical Text Analytics- Maximizing the value of Text Data, Murugan Anandarajan, Chelsey Hill, Thomas Nolan, Springer, Vol . 2, 2019 | | | | | | | | | | | | | |
| 3 | Text Mining in Practice with R, Ted Kwartler, Wiley,2017 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | |
| 1 | Applied Text Analysis with Pythod- Enabling language-aware data products with machine learing, Benjamin bengfort, Rebecca bilbro &Tony Ojeda, O’reilly, 2018 | | | | | | | | | | | | | |
| 2 | Seven Layers of Social Media Analytics\_ Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, and Location Data,Gohar F. Khan, E-Book , 2015 | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | |
| 1 | | https://www.coursera.org/learn/text-mining | | | | | | | | | | | | |
| 2 | | https://www.tutorialspoint.com/big\_data\_analytics/text\_analytics.htm | | | | | | | | | | | | |
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| Course Designed By: Dr. K. Geetha | | | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **S** | **S** | **S** | **M** | L | **M** | L | **M** |
| CO3 | **S** | **S** | **S** | **S** | **S** | **M** | L | **M** | L | **M** |
| CO3 | **S** | **S** | **S** | **S** | **S** | **M** | L | **M** | L | **M** |
| CO4 | **S** | **S** | **S** | **S** | **S** | **M** | L | **M** | L | **M** |
| CO5 | **S** | **S** | **S** | **S** | **S** | **M** | L | **M** | L | **M** |

\*S-Strong; M-Medium; L-Low

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| **Course code** | | | | **24DS3E8** | | **DIGITAL MARKETING ANALYTICS** | | | **L** | | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **ELECTIVE** | | | **4** | | | |  | **0** | **4** |
| **Pre-requisite** | | | | | | There is no prerequisite. However, students would have to become comfortable with data analysis. It would be easier if students have knowledge in handling digital gadgets and about business processes | | | **Syllabus Version** | | | | | **2024-25** | |
| **Course Objectives:** | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To cover some of the most important aspects of digital marketing analytics since it is the essential tool for optimizing and connecting results of all digital marketing tactics 2. To focus on how digital data handled in media including search, social media, email in the business perspective 3. Will focus on enriching student knowledge in analytics techniques for managerial decisions, which have emerged as the critical assets to business professionals and firms now-a-days | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | |
| 1 | | | Understand how digital marketing transformed to digital marketing and the technology behind digital marketing | | | | | | | | | K1/K2/K3 | | | |
| 2 | | | To know the key elements of a digital marketing strategy | | | | | | | | | K2/K3 | | | |
| 3 | | | To understand the requirement to implement digital business such as domain registration, website development, website up gradation etc. | | | | | | | | | K2/K3/K4 | | | |
| 4 | | | To understand how social media can be used for business and its impacts. | | | | | | | | | K2/K3/K4 | | | |
| 5 | | | To know analytics tools for business summarization | | | | | | | | | K2/K3 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Digital Marketing** | | | | | | **8-- hours** | | | | |
| Introduction about digital marketing- How have digital technologies transformed marketing?- Digital marketing in practice - Definitions – what are digital marketing and multichannel marketing? Paid, owned and earned media -The growing range of digital marketing platforms - The technology behind digital marketing. | | | | | | | | | | | | | | | |
| **Unit:2** | | | | | **Digital Marketing Strategy Development** | | | | | **12-- hours** | | | | | |
| Introduction to digital marketing strategy - Key features of digital marketing strategy -Applications of digital marketing -Benefits of digital marketing - Alternative digital business models - The difference between e-commerce and e-business - Different forms of online presence - Challenges in developing and managing digital marketing strategy - A strategic framework for developing a digital marketing strategy | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Digital Marketing Implementation** | | | **12-- hours** | | | | | | | |
| Introduction : Creating effective digital experiences -Digital marketing in practice- Planning website design and redesign projects - Who should be involved in a website project? - Prototyping and agile software development - Initiation of the website project - Domain name selection and registration - Website performance optimization - Defining site or app requirements - Business requirements - Usability requirements - Designing the information architecture -Mobile design considerations and techniques - Multichannel communications preferences - The relationship between service quality, customer. | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **Social Media analytics** | | | **10-- hours** | | | | | | | |
| Social Business Fundamentals - Social Media and Customer Engagement - The Social Feedback Cycle - Open Access to Information -Social Analytics - Quantitative Measurement - The Need to Measure More - Source and Sentiment Analysis - The Role of Trust - Web Analytics .-Website Performance - Business Analytics - Offline and Non business Processes - Sources of Business Analytics . | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Digital Marketing tools** | | **8-- hours** | | | | | | | | |
| Different types of social media marketing tools - The medium changes the nature of standard marketing communications tools such as advertising - Selecting the right mix of digital media communications tools -Tools and techniques for collecting metrics and summarizing results - The Tools that Power a Social Graph | | | | | | | | | | | | | | | |
| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **52-- hours** | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | |
| 1 | Dave Chaffey, Fiona Ellis-Chadwick, “Digital Marketing – Strategy, Implementation and Practice”, Pearson Education, Sixth edition, ISBN-13: 978-1292077611, 2016. | | | | | | | | | | | | | | |
| 2 | Social Media Marketing- the next generation of business engagement, Dave Evans and Jake McKee, Wiley Publishing , Inc. ,2010 | | | | | | | | | | | | | | |
| 3 | Social Media Analytics Strategy- Using Data to optimize Business Performance, Alex Goncalves, Apress, 2017 | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | |
| 1 | Damian Ryan, Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation Paperback – Import, Kogan Page, Fourth Edition, | | | | | | | | | | | | | | |
| 2 | Marketing 4.0- Moving from Traditional to Digital, Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Wiley Publishing, 2017 | | | | | | | | | | | | | | |
| 3 | Advanced Social Media Marketing- how to lead, launch and manage a successful social media program, Tom Funk, Aprss,2013 | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | |
| 1 | | https://www.coursera.org/learn/digital-analytics | | | | | | | | | | | | | |
| 2 | | https://www.tutorialspoint.com/digital\_marketing/digital\_marketing\_web\_analytics.htm | | | | | | | | | | | | | |
| Course Designed By: Dr. K. Geetha | | | | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| CO1 | **S** | **S** | **S** | **S** | **M** | **M** | L | L | **M** | **S** |
| CO3 | **S** | **S** | **S** | **S** | **M** | **M** | L | L | **M** | **S** |
| CO3 | **S** | **S** | **S** | **S** | **M** | **M** | L | L | **M** | **S** |
| CO4 | **S** | **S** | **S** | **S** | **M** | **M** | L | L | **M** | **S** |
| CO5 | **S** | **S** | **S** | **S** | **M** | **M** | L | L | **M** | **S** |

\*S-Strong; M-Medium; L-Low

JOB ORIENTED

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VALUE ADDED COURSES

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| **JOB ORIENTED COURSE: DATA ANALYSIS USING EXCEL** | | | | | | | | |
| **Name of the Department** | | | | | **Computer Science** | | | |
| **Name of the Faculty Member i/c**  **with Complete Address with Phone and**  **E-mail** | | | | | Dr. S. Vijayarani  Assistant Professor  Department of Computer Science  Bharathiar University, Coimbatore – 641 046  [vijayarani@buc.edu.in](mailto:vijayarani@buc.edu.in) | | | |
| **Inter / Intra Department Course** | | | | | **Intra Department Course** | | | |
| **Duration of the Course** | | | | | **30 Hours** | | | |
| **Eligibility** | | | | | U.G. in Computer Science / Computer  Applications / Information Technology or its  equivalent | | | |
| **Number of Candidates to be Admitted** | | | | | **30** | | | |
| **Mode of the Course** | | | | | **Both Regular and Online** | | | |
| **Collaboration if any with Companies**  (if Yes, Full Address of the Company Address ,  Name of the Contact Person, Phone, e-mail etc.) | | | | | **---** | | | |
| **Registration Procedure** | | | | |  | | | |
| **Job Opportunities:** | | | | |  | | | |
| * Data Analyst * Data Scientist | | | | | | | | |
| The main objectives of this course are:   1. To understand the basics of the analysis process in Excel 2. To remember the various components and their functions in the Excel worksheet 3. To learn about advanced formulas creation and charts preparation 4. To implement different kinds of data analysis tasks 5. To handle pivot tables and macros | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, students will be able to: | | | | | | | | |
| 1 | | | Understand the need for MS-Excel and the working of various components | | | | | K1/K2/K4 |
| 2 | | | Experiment with the given data by using different functions, ranges and formulas | | | | | K2/K3/K4 |
| 3 | | | Evaluate the data analysis results and visualize them by using charts | | | | | K4/K5/K6 |
| 4 | | | Analyze the pivot tables and the different spreadsheet tools | | | | | K4/K5 |
| 5 | | | Create the macros and applied them for analytical tasks | | | | | K4 / K6 |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | |
|  | | | | | | | | |
| **Course Content** | | | | **Lecture / Practical / Project / Internship** | | | | |
| **DATA ANALYSIS USING EXCEL (30 Hours, 2 Credits)** | | | | | | | | |
| **Module 1** | | | | **Introduction to Excel:** About Excel & Microsoft, Uses of Excel, Excel software, Spreadsheet window pane, Title Bar, Menu Bar, Standard Toolbar, Formatting Toolbar, the Ribbon, File Tab and Backstage View, Formula Bar, Workbook Window, Status Bar, Task Pane, Workbook & sheets | | 3 Hours | | |
| **Module 2** | | | | **Columns & Rows:**  Selecting Columns & Rows, Changing Column Width & Row Height, Autofitting Columns & Rows, Hiding/Unhiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell – Format, value, formula, Use of paste and paste special | | | 3 Hours | |
| **Module 3** | | | | **Functionality Using Ranges:** Using Ranges, Selecting Ranges, Entering Information into a Range, Using AutoFill | | | 2 Hours | |
| **Module 4** | | | | **Creating Formulas:** Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum | | | 4 Hours | |
| **Module 5** | | | | **Advance Formulas:** Concatenate, Vlookup, Hlookup, Match, Countif, Text, Trim | | | 3 Hours | |
| **Module 6** | | | | **Spreadsheet Charts:**  Creating Charts, Different types of charts, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table | | | 4 Hours | |
| **Module 7** | | | | **Data Analysis:** Sorting, Filter, Text to Column, Data Validation | | | 3 Hours | |
| **Module 8** | | | | **PivotTables:**  Creating PivotTables, Manipulating a PivotTable, Using the PivotTable Toolbar, Changing Data Field, Properties, displaying a PivotChart, Setting PivotTable Options. Adding Subtotals to PivotTables | | | 3 Hours | |
| **Module 9** | | | | **Spreadsheet Tools:** Moving between Spreadsheets, Selecting Multiple Spreadsheets, Inserting and Deleting Spreadsheets Renaming Spreadsheets, Splitting the Screen, Freezing Panes, Copying and Pasting Data between Spreadsheets, Hiding, Protecting worksheets | | | 3 Hours | |
| **Module 10** | | | | **Making Macros:** Recording Macros, Running Macros, Deleting Macros | | | 2 Hours | |
| **Text Books** | | | | | | | | |
| 1 | Hector Guerrero, Excel Data Analysis Modeling and Simulation, Second Edition, Springer, 2019 | | | | | | | |
| 2 | Berk & Carey, Data Analysis with Microsoft Excel, Brooks / Cole Cengage Learning, 2010 | | | | | | | |
| 3 | Ash Narayan Sah, Data Analysis using Microsoft Excel, Excel Books, 2009 | | | | | | | |
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| **Reference Books** | | | | | | | | |
| 1 | Stephen Nelson and Elizabeth C.Nelson, Excel Data Analysis for Dummies, 3rd Edition, John Wiley & Sons, Inc., 2016 | | | | | | | |
| 2 | Paul McDefries, Microsoft Excel Data Analysis for Dummies, John Wiley & Sons, Inc., 2019 | | | | | | | |
|  | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | |
| 1 | | https://www.coursera.org/learn/excel-data-analysis | | | | | | |
| 2 | | https://www.datacamp.com/courses/data-analysis-in-excel | | | | | | |
| 3 | | https://online.rice.edu/courses/excel-data-analysis | | | | | | |
| 4 | | https://www.tutorialspoint.com/excel\_data\_analysis/index.htm | | | | | | |
| 5 | | https://www.excel-easy.com/data-analysis.html | | | | | | |

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| **JOB ORIENTED COURSE : POWER BI FOR DATA ANALYTICS** | | | | | | | | |
| **Name of the Department** | | | | | **Computer Science** | | | |
| **Name of the Faculty Member i/c**  **with Complete Address with Phone and**  **E-mail** | | | | | Dr. S. Vijayarani  Assistant Professor  Department of Computer Science  Bharathiar University, Coimbatore – 641 046  [vijayarani@buc.edu.in](mailto:vijayarani@buc.edu.in) | | | |
| **Inter / Intra Department Course** | | | | | **Intra Department Course** | | | |
| **Duration of the Course** | | | | | **30 Hours** | | | |
| **Eligibility** | | | | | U.G. in Computer Science / Computer  Applications / Information Technology or its  equivalent | | | |
| **Number of Candidates to be Admitted** | | | | | **40** | | | |
| **Mode of the Course** | | | | | **Both Regular and Online** | | | |
| **Collaboration if any with Companies**  (if Yes, Full Address of the Company Address ,  Name of the Contact Person, Phone, e-mail etc.) | | | | | **---** | | | |
| **Registration Procedure** | | | | |  | | | |
| **Job Opportunities:** | | | | |  | | | |
| * Data Analyst * Data Scientist | | | | | | | | |
| The main objectives of this course are:  To understand the key concepts of business intelligence and the Power BI ecosystem   1. To perform different operations by using the data 2. To learn about the creation of data models and final reports 3. To understand the use of dashboards, apps and security 4. To conduct the business data analysis tasks | | | | | | | | |
|  | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, students will be able to: | | | | | | | | |
| 1 | | | Understand the key concepts of business intelligence and Power BI Desktop | | | | | K1/K2 |
| 2 | | | Perform data transformation tasks and create the data models | | | | | K3 / K6 |
| 3 | | | Apply advanced visualization and create the reports | | | | | K3/K4/K6 |
| 4 | | | Create the dashboards and apps | | | | | K4/K5/K6 |
| 5 | | | Use data gateways and refreshing datasets. | | | | | K3/K4/K5 |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | |
|  | | | | | | | | |
| **Course Content** | | | | **Lecture / Practical / Project / Internship** | | | | |
| **POWER BI FOR DATA ANALYTICS (30 Hours, 2 Credits)** | | | | | | | | |
| **Module 1** | | | | **Introduction to Power BI:** Key concepts of business intelligence, The Power BI ecosystem, Power BI Licensing, Power BI Desktop and Service | | 3 Hours | | |
| **Module 2** | | | | **Power BI Desktop:** Downloading and installing Power BI Desktop, Touring the Desktop, generating data, Creating Visualizations | | | 3 Hours | |
| **Module 3** | | | | **Connecting and Shaping Data:** Getting data, transforming data, Merging, Copying and Appending Queries, Verifying and Loading data | | | 2 Hours | |
| **Module 4** | | | | **Creating Data Models and Calculations:** Creating a data model, creating calculations, checking and troubleshooting calculations | | | 4 Hours | |
| **Module 5** | | | | **Unlocking Insights:** Segmenting data, Using report navigation features, Advanced visualization techniques | | | 3 Hours | |
| **Module 6** | | | | **Creating the final report:**  Preparing the final report, creating the final report pages, Finishing up | | | 4 Hours | |
| **Module 7** | | | | **The Service:** Getting an account, Introducing the Service, Publishing and Sharing | | | 3 Hours | |
| **Module 8** | | | | **Using Reports in the Service:**  Viewing reports, exporting reports, embedding reports, Editing and creating reports | | | 3 Hours | |
| **Module 9** | | | | **Understanding Dashboards, Apps and Security:** Understanding dashboards, understanding apps, Understanding security and permissions | | | 3 Hours | |
| **Module 10** | | | | **Data Gateways and Refreshing Datasets:** Installing and using data gateways, Refreshing datasets | | | 2 Hours | |
|  | | | | | | | | |
| **Text Books** | | | | | | | | |
| 1 | Greg Deckler Learn Power BI - A beginner's guide to developing interactive business intelligence solutions using Microsoft Power BI, Packt Publishing, 2019 | | | | | | | |
|  | | | | | | | | |
| **Reference Books** | | | | | | | | |
| 1 | Alberto Ferrari and Marco Russo, Introducing Microsoft Power BI, Microsoft Press, 2016 | | | | | | | |
| 2 | Devin Knight, Brian Knight, Mitchell Pearson, Manuel Quintana, Brett Powell, Microsoft Power BI Complete Reference- Bring your data to life with the powerful features of Microsoft  Power BI, Packt Publishing, 2018 | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | |
| 1 | | https://powerbi.microsoft.com/en-us/learning/ | | | | | | |
| 2 | | https://www.udemy.com/topic/microsoft-power-bi/ | | | | | | |
| 3 | | https://www.simplilearn.com/power-bi-certification-training-course | | | | | | |
| 4 | | https://intellipaat.com/power-bi-training/ | | | | | | |
| 5 | | https://www.tutorialspoint.com/power\_bi/index.htm | | | | | | |
| 6 | | https://www.javatpoint.com/power-bi | | | | | | |
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| **VALUE ADDED COURSE: SOFTWARE TESTING TOOLS** | | | | | | | |
| **Name of the Department** | | | | | | **Computer Science** | |
| **Name of the Faculty Member i/c**  **With Complete Address with Phone and e-mail** | | | | | | **Dr.K. Geetha**  Assistant Professor  Department of Computer Science Bharathiar University Coimbatore – 641 046.  Phone **: 9965497121**  E mail **: geetha.k@buc.edu.in** | |
| **Inter / Intra Department Course** | | | | | | **Intra Department Course** | |
| **Duration of the Course** | | | | | | **30 Hours** | |
| **Eligibility** | | | | | | U.G. in Computer Science/Computer Applications/Information Technology or its  equivalent | |
| **Number of Candidates to be Admitted** | | | | | | 40 | |
| **Registration Procedure** | | | | | |  | |
| **Job Opportunities:** Opportunities available in IT sectors | | | | | | | |
|  | | | | | | | |
| **The objectives of the Course are:** | | | | | | | |
| The main objectives of this course are to: | | | | | | | |
| 1 | | Inculcate the knowledge on the fundamentals of security | | | | | |
| 2 | | Present the different types of software testing, | | | | | |
| 3 | | Learn the different types of errors | | | | | |
| 4 | | Examine the tools for Software Testing | | | | | |
| 5 | | Testing few test cases using tool | | | | | |
|  | | | | |  | | |
| **Course Content** | | | | | Lecture / Practical / Project / Internship | | |
| **Expected Course Outcomes** | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | |
| 1 | | | Understand and Remember the basic concepts of Software Testing | | | | K1/K2 |
| 2 | | | Understand and Remember the types of testing | | | | K1/K4 |
| 3 | | | Analyze the types of errors | | | | K2/K4 |
| 4 | | | Analyze and developing test cases | | | | K2/K4/K6 |
| 5 | | | Experimenting test cases using testing tools available as open source | | | | K3/K4/K5 |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | |
| **Module 1** | | | | Introduction to Software Testing and Terminology | | | **2 hours** |
| **Module 2** | | | | Types of Testing | | | **2 hours** |
| **Module 3** | | | | Types of errors | | | **2 hours** |
| **Module 4** | | | | Penetration testing and security | | | **2 hours** |
| **Module 5** | | | | Types of Hacking | | | **2 hours** |
| **Module 6** | | | | Developing test cases | | | **4hours** |
| **Module 7** | | | | Unit testing - test cases | | | **4 hours** |
| **Module 8** | | | | Functional testing with test cases | | | **4 hours** |
| **Module 9** | | | | Security testing with test cases | | | **4 hours** |
| **Module 10** | | | | Penetration testing with test cases | | | **4 hours** |
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| **Text Book(s)** | | | | | | | |
| 1 | Software Testing- A Craftsman’s Approach, Paul C. Jorgensen, Fourth Edition, CRC Press, 2014 | | | | | | |
| 2 | Penetration Testing- A Hands-On Introduction to Hacking, by Georgia Weidman, No Starch Press, USA, 2014 | | | | | | |
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| **Related Online Contents** | | | | | | | |
| 1 | https://www.tutorialspoint.com/software\_testing/index.htm | | | | | | |
| 2 | https://www.geeksforgeeks.org/software-testing-basics/ | | | | | | |

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| **VALUE ADDED COURSE:** **CYBER SECURITY AND DIGITAL FORENSICS** | | | | | | | |
| **Name of the Department** | | | | | | **Department of Computer Science** | |
| **Name of the Faculty Member i/c**  **With Complete Address with Phone and e-mail** | | | | | | **Dr. R. Porkodi**  **Associate Professor**  **Department of Computer Science**  **Bharathiar University**  **Coimbatore – 46**  **0422-2428349**  **porkodi\_r76@buc.edu.in** | |
| **Inter / Intra Department Course** | | | | | | **Intra Department Course** | |
| **Duration of the Course** | | | | | | **30 hrs** | |
| **Eligibility** | | | | | |  | |
| **Number of Candidates to be Admitted** | | | | | | **40** | |
| **Mode of the Course** | | | | | | **Both Regular and Online** | |
| **Collaboration if any with Companies**  (if Yes, Full Address of the Company Address , Name of the Contact Person, Phone, e-mail etc.) | | | | | | **---** | |
| **Registration Procedure** | | | | | |  | |
| **Job Opportunities:** | | | | | | | |
| * To become cyber security expert to identify IT breaches, vulnerabilities and threats facing companies in today’s digital world. | | | | | | | |
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| **The objectives of the Course are:** | | | | | | | |
|  | | | | | | | |
| 1 | | | To learn the impact of Cyber security risk in an Ethical, Social, and Professional Manner | | | | |
| 2 | | | To provide knowledge on data acquisition methods, tools, collecting, preserving and seizing of various digital evidences. | | | | |
| 3 | | | To understand the security services for email | | | | |
| **Course Outcomes:** | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | |
| 1 | | | Understand the basics of cyber space, ethical hacking and attacks in cyber world. | | | | |
| 2 | | | Understand unauthorized access to digital devices and cyber psychology. | | | | |
| 3 | | | Study of Collection of evidences, preservation and forensic analysis. | | | | |
| 4 | | | Describe the digital forensics software and hardware, tools, technologies, and practices in forensics. | | | | |
| 5 | | | Understanding the email tracking, IP tracking, cracking of passwords and forensic analysis of different artifacts. | | | | |
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| **Course Content** | | | | | Lecture / Practical / Project / Internship | | |
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| **Module 1** | | | | Ethical hacking, Attack Vectors, Cyberspace and Criminal Behaviour, Traditional Problems associated with Computer Crimes, brief history of the internet, contaminants and destruction of data, unauthorized access. | | | **3 hrs** |
| **Module 2** | | | | Computer intrusions, white-collar crimes, viruses and malicious code, virus attacks, pornography, software piracy, mail bombs, exploitation, stalking and obscenity in internet. | | | **3 hrs** |
| **Module 3** | | | | Introduction to Digital forensics, Forensic software and handling, forensic hardware and handling. Forensic analysis and its advanced tools, forensic technology and practices. | | | **3 hrs** |
| **Module 4** | | | | Biometrics: face, iris and fingerprint recognition, Audio-video evidence collection, Preservation and Forensic Analysis. | | | **3 hrs** |
| **Module 5** | | | | Investigation Tools, e-discovery, EDRM Models, digital evidence collection and preservation. | | | **3 hrs** |
| **Module 6** | | | | Email investigation, email tracking, IP tracking, email recovery, | | | **3 hrs** |
| **Module 7** | | | | search and seizure of computer systems, password cracking. | | | **3 hrs** |
| **Module 8** | | | | Forensic Analysis of OS artifact, Internet Artifacts, File System Artifacts, Registry Artifacts, Application Artifacts. | | | **3 hrs** |
| **Module 9** | | | | Report Writing, Mobile Forensic- identification, collection and preservation of mobile evidences. | | | **3 hrs** |
| **Module 10** | | | | Social media analysis, data retrieval, Email analysis from mobile phones. | | | **3 hrs** |
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| **Book(s) for Study** | | | | | | | |
| 1 | M.T.Britz, Computer Forensics and Cyber Crime, Pearson Education, 2012. | | | | | | |
| 2 | Charles P. Fleeger, "Security in Computing", Prentice Hall, New Delhi, 2009. | | | | | | |
| 3 | BehrouzA.Forouzan, Cryptography & Network Security, Tata McGraw Hill, India, New Delhi, 2009. | | | | | | |
|  | | | | | | | |
| **Book(s) for reference** | | | | | | | |
| 1 | Bruce Schneier, Applied Cryptography, John Wiley & Sons, New York, 2004. | | | | | | |
| 2 | William Stallings, Cryptography and Network Security, Prentice Hall, New Delhi, 2006. | | | | | | |
| 3 | Neal Krawetz, Introduction to Network Security, Thomson Learning, Boston, 2007. | | | | | | |
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| **Related Online Contents** | | | | | | | |
| 1 | | https://www.w3schools.com › cybersecurity | | | | | |
| 2 | | https://www.javatpoint.com/cyber-security-tutorial | | | | | |
| 3 | | https://www.tutorialspoint.com/python\_digital\_forensics | | | | | |
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| **JOB ORIENTED COURSE -** **MOBILE APPLICATION DEVELOPMENT** | | | | | | | |
| **Name of the Department** | | | | | | **Computer Science** | |
| **Name of the Faculty Member i/c**  **With Complete Address with Phone and e-mail** | | | | | | **Dr. R. Porkodi**  **Associate Professor**  **Department of Computer Science**  **Bharathiar University**  **Coimbatore – 46**  **0422-2428349**  **porkodi\_r76@buc.edu.in** | |
| **Inter / Intra Department Course** | | | | | | **Intra Department Course** | |
| **Duration of the Course** | | | | | | **30 Hours** | |
| **Eligibility** | | | | | | U.G. in Computer Science/Computer Applications/Information Technology or its equivalent | |
| **Number of Candidates to be Admitted** | | | | | | **40** | |
| **Mode of the Course** | | | | | | **Both Regular and Online** | |
| **Collaboration if any with Companies**  (if Yes, Full Address of the Company Address , Name of the Contact Person, Phone, e-mail etc.) | | | | | | **---** | |
| **Registration Procedure** | | | | | |  | |
| **Job Opportunities:** | | | | | | | |
| * To become mobile app developer in Retail, healthcare sector, Travel and tourism industry, Entertainment industry, Financial services and Media organizations. | | | | | | | |
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| **The objectives of the Course are:** | | | | | | | |
|  | | | | | | | |
| 1 | | | Provides a comprehensive overview and focuses on developing multiplatform mobile applications using the Web skills. | | | | |
| 2 | | | Strengthen the skills of students in learning hybrid application framework to develop and target multiple mobile platforms with a single codebase. | | | | |
| 3 | | | Enrich the knowledge of students in Ionic one of fastest growing mobile application framework. | | | | |
| 4 | | |  | | | | |
| **Course Outcomes:** | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | |
| 1 | | | Understand the basics of mobile devices, app store, development environments, characteristics, history of mobile application frameworks. | | | | |
| 2 | | | Understand the mobile application frameworks and setting up java, eclipse, android development components. Creating user interface design for mobile applications and managing application data. | | | | |
| 3 | | | Understanding the enterprise requirements and testing methodologies for mobile applications. | | | | |
| 4 | | | Understanding the hybrid mobile app development frameworks: CSS3, HTML 5, Iconic, Angular JS, Node.JS and developing the hybrid mobile applications | | | | |
| 5 | | | Understanding the mobile app deployment process, Usage of Sqlite, mongo DB and Mysql and IBM BlueMix. | | | | |
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| **Course Content** | | | | | Lecture / Practical / Project / Internship | | |
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| **Module 1** | | | | Introduction to Mobile Devices: Introduction - Mobile vs. Desktop devices - App Store, Google Play, Windows Store - Development environments - PhoneGAP | | | **3 hours** |
| **Module 2** | | | | Native vs. web applications - Mobile Connectivity Evolution - Characteristics of mobile applications - History of mobile application frameworks | | | **3 hours** |
| **Module 3** | | | | Application models of mobile application frameworks - Setting up an android development environment: setting up java, eclipse, android development components, verify the development environment | | | **3 hours** |
| **Module 4** | | | | User interface design for mobile applications - Managing application data | | | **3 hours** |
| **Module 5** | | | | Addressing enterprise requirements in mobile applications: performance, scalability, modifiability, availability, and security | | | **3 hours** |
| **Module 6** | | | | Testing methodologies for mobile applications - Publishing, deployment, maintenance and management | | | **3 hours** |
| **Module 7** | | | | Hybrid Mobile App Development Frameworks: Introduction to CSS3.HTML5 - Full-Stack Web Development | | | **3 hours** |
| **Module 8** | | | | Hybrid Mobile App Development: Ionic and AngularJS - node.JS | | | **3 hours** |
| **Module 9** | | | | APP deployment: Angular ui-router and Resolve - Using Local Storage(Sqlite) -Databases - mongoDB, MySQL | | | **3 hours** |
| **Module 10** | | | | Ionic Adding Platforms - Building and Deploying the App - Hybrid Mobile Development and IBM BlueMix | | | **3 hours** |
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| **Text Book(s)** | | | | | | | |
| 1 | Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 3rd edition, 2017. | | | | | | |
| 2 | Rajiv Ramnath, Roger Crawfis, and Paolo Sivilotti, Android SDK 3 for Dummies, Wiley. | | | | | | |
| 3 | Brian Fling, Mobile Design and Development, O’Reilly Media, Inc., 2009. | | | | | | |
|  | | | | | | | |
| **Reference Book(s)** | | | | | | | |
| 1 | Maximiliano Firtman, Programming the Mobile Web, O’Reilly Media, Inc., 2nd ed., 2013. | | | | | | |
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| **Related Online Contents** | | | | | | | |
| 1 | | <https://developer.android.com/> | | | | | |
| 2 | | <https://www.w3schools.in/category/android-tutorial/> | | | | | |
| 3 | | <https://www.tutorialspoint.com/android/index.htm> | | | | | |
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| **JOB ORIENTED COURSE -** **SMART APPLICATIONS WITH INTERNET OF THINGS** | | | | | | | | | |
| **Name of the Department** | | | | | | | **Computer Science** | | |
| **Name of the Faculty Member i/c**  **With Complete Address with Phone and e-mail** | | | | | | | Dr.P.B.Pankajavalli  Assistant Professor  Dept. of Computer Science  Bharathiar University, Coimbatore  Phone : 2428603, pankajavalli@buc.edu.in | | |
| **Inter / Intra Department Course** | | | | | | | Intra Department Course | | |
| **Duration of the Course** | | | | | | | 30 Hours | | |
| **Eligibility** | | | | | | | U.G. in Computer Science/Computer Applications/Information Technology or its equivalent | | |
| **Number of Candidates to be Admitted** | | | | | | | 40 | | |
| **Mode of the Course** | | | | | | | **Both Regular and Online** | | |
| **Collaboration if any with Companies**  (if Yes, Full Address of the Company Address , Name of the Contact Person, Phone, e-mail etc.) | | | | | | | **No** | | |
| **Registration Procedure** | | | | | | |  | | |
| **Job Opportunities:** | | | | | | | | | |
| Hardware and device development, Sensor networking professionals | | | | | | | | | |
| IoT cloud engineer, Product Manager | | | | | | | | | |
| **The objectives of the Course are:** | | | | | | | | | |
| The main objectives of this course are to: | | | | | | | | | |
| 1 | | | To understand the concept of sensors and microcontrollers | | | | | | |
| 2 | | | To remember basic syntax in C programming | | | | | | |
| 3 | | | To apply sensor on microcontrollers | | | | | | |
| 4 | | | To understand the interfacing of cloud with sensors | | | | | | |
| 5 | | | To evaluate and visualize the data in the cloud | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | |
| 1 | | | | Understand the basics of sensors and sensor networks | | | | K2/K3 | |
| 2 | | | | Create basic arduino code and to gain knowledge on built in code | | | | K1/K2/K4 | |
| 3 | | | | Develop small IoT prototype using different sensors. | | | | K3/K4 | |
| 4 | | | | Explore the usage of buzzers, motors, relays and LED lights | | | | K3/K4 | |
| 5 | | | | Deploy interface with cloud and to visualize data | | | | K2/K3/K5 | |
| **K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5- Create** | | | | | | | | | |
| **Course Content** | | | | | | **Lecture / Practical** / Project / Internship | | | |
| **Smart Applications with Internet of Things (30 Hours, 2 credits)** | | | | | | | | | |
| **Module 1** | | | | | Anatomy of Sensors Networks – Topology of Sensor Network – Type of Sensor Nodes – Sensors- Sensors measures | | | | **2 hours** |
| **Module 2** | | | | | Analog Sensors- Digital Sensors – Storing senor data – Examples | | | | **2 hours** |
| **Module 3** | | | | | Understanding the Arduino board – Arduino Board types- Virtronics Simulator for Arduino- Tinkercad -Arduino IDE - Installing and Setting up the Arduino IDE - Connecting the Arduino IDE with devices | | | | **3 hours** |
| **Module 4** | | | | | Program Structure in C - Basic Syntax - Data Types / Variables / Constants - Operators, Conditional Statements and Loops -Functions, Array and Pointers - Strings and I/O - Arduino C Library functions - Working with Arduino inbuilt examples. | | | | **4 hours** |
| **Module 5** | | | | | Understanding Sensors and Devices - Understanding basic electronic components and power elements - Understanding the Inputs from Sensors - Working with Temperature Sensors, Ultrasound Sensor, Humidity sensor, Motion Sensor | | | | **3 hours** |
| **Module 6** | | | | | Working with IR Sensor - Working with Proximity Sensor - Working with Photo Diode - Working with Accelerometer and vibration sensor - Introduction to Raspberry Pi. | | | | **3 hours** |
| **Module 7** | | | | | Understanding the Outputs - Activating LED Lights - Activating Relays - Activating Buzzer | | | | **3 hours** |
| **Module 8** | | | | | Running DC Motors - Running - Stepper Motors and Servo Motors | | | | **3 hours** |
| **Module 9** | | | | | Introduction to cloud – Thingspeak IoT Analytics Platform – API key – Thingspeak login – API Key Process | | | | **3 hours** |
| **Module 10** | | | | | ESP8266 WI-FI Module – Installation of ESP8266 board package to Arduino IDE – Circuit Diagram – Graph visualization – Introduction to Adafruit, Bolt, Blynk, and ​IFTTT | | | | **4 hours** |
|  | | | | |  | | | |  |
| **Text Book(s)** | | | | | | | | | |
| 1 | Michael Margolis, “Arduino Cookbook” 2nd Edition, O'Reilly Media, 2011. | | | | | | | | |
| 2 | Charles Bell, “Beginning Sensor Networks with Arduino and Raspberry Pi”, 1st Edition, Technology in Action, 2013. | | | | | | | | |
|  | | | | | | | | | |
| **Reference Book(s)** | | | | | | | | | |
| 1 | Arvind Ravulavaru, Enterprise Internet of Things Handbook: Build end-to-end IoT solutions using popular IoT platforms, Packt Publishing Limited, 2018. | | | | | | | | |
|  | | | | | | | | | |
| **Related Online Contents** | | | | | | | | | |
| 1 | | <https://electronics-project-hub.com/send-data-to-thingspeak-using-esp8266/> | | | | | | | |
| 2 | | <https://virtronics.com.au/Simulator-for-Arduino.html> | | | | | | | |
| 3 | | <https://www.instructables.com/id/ESP8266-to-IFTTT-Using-Arduino-IDE/> | | | | | | | |
| Course Designed by: Dr.P.B.Pankajavalli | | | | | | | | | |

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| **VALUE ADDED COURSE -** **REMOTE SENSING AND GIS** | | | | | | | |
| **Name of the Department** | | | | | | **Computer Science** | |
| **Name of the Faculty Member i/c**  **With Complete Address with Phone and e-mail** | | | | | | **Dr.D.Napoleon**  Assistant Professor  Department of Computer Science  Bharathiar University  Coimbatore – 641 046.  Phone **: 9655162717**  E mail **: mekaranapoleon@yahoo.co.in** | |
| **Inter / Intra Department Course** | | | | | | **Intra Department Course** | |
| **Duration of the Course** | | | | | | **30 Hours** | |
| **Eligibility** | | | | | | U.G. in Computer Science/Computer Applications/Information Technology or its equivalent | |
| **Number of Candidates to be Admitted** | | | | | | 40 | |
| **Registration Procedure** | | | | | |  | |
| **Job Opportunities: GIS Analysts/Sr. GIS Analyst,** **GIS Engineer, Senior GIS Executive,** **Sr. Modeling Analyst** | | | | | | | |
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| **The objectives of the Course are:** | | | | | | | |
| The main objectives of this course are to: | | | | | | | |
| 1 | | | Explain the basics of geographic information systems (GIS) and related areas such as geodesy and remote sensing | | | | |
| 2 | | | Select and acquire both primary and secondary spatial data for use in GIS | | | | |
| 3 | | | Manage, and analyze digital data in raster and vector formats | | | | |
| 4 | | | Describe how common analytical methods and techniques work | | | | |
| 5 | | | Create and present a GIS project. | | | | |
| **Course Content** | | | | | Lecture / Practical / Project / Internship | | |
| **Expected Course Outcomes** | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | |
|  | | | | | | | |
| **1.** | | | | Understand and Remember the basic concepts of remote sensing | | | K1/K2 |
| **2.** | | | | Understand and Remember the functionalities of GIS-Photogrammetry | | | K1/K2 |
| **3.** | | | | Analyze the Statistical Concepts based on the Images | | | K2/K4 |
| **4.** | | | | Analyze and Evaluate the case studies | | | K3/K4/k5 |
| **5.** | | | | Create and analyze environmental Monitoring and Assessment | | | K2/K4/K6 |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | |
| **Module 1** | | | | Fundamentals & Physics of Remote Sensing- Platforms and Sensors-Fundamentals of Geographic Information System-Digital Cartography-Photogrammetry-Surveying and Global Positioning System | | | **2 hours** |
| **Module 2** | | | | Fundamentals of GIS-Photogrammetry, Surveying& GPS-Information Extraction from Satellite Images-Thermal and Microwave Remote Sensing-Hyper spectral Remote Sensing | | | **2 hours** |
| **Module 3** | | | | GIS Data Analysis-Geodesy-Fundamental Statistical Concepts-Geo-statistics & Statistical applications in GIS | | | **4 hours** |
| **Module 4** | | | | Advance Remote Sensing: Data Processing & Applications-Fundamental Statistical Concepts & Geo-Statistics | | | **4 hours** |
| **Module 5** | | | | Application of Geo-informatics-Spatial decision support system | | | **6 hours** |
| **Module 6** | | | | Fundamental of Research-Research Methodology and Project Management | | | **6 hours** |
| **Module 7** | | | | Application of Geo-Informatics and Spatial Decision Support System | | | **4 hours** |
| **Module 8** | | | | Generation of Case Studies(Compulsory Field study) | | | **4 hours** |
| **Module 9** | | | | Environmental Monitoring and Assessment- QGIS Customization Using Python | | | **4 hours** |
| **Module 10** | | | | Customization of Geospatial Tools-GIS Customization Using ArcGIS | | | **4 hours** |
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| **Text Book(s)** | | | | | | | |
| 1 | George Joseph and C Jeganathan, Fundamentals of Remote Sensing,3rd Edition, January 2018 | | | | | | |
| 2 | Lillesand , Kiefer, Chipman ,Remote Sensing and Image Interpretation, 6th Edition, January 2011 | | | | | | |
| 3 | Basudeb Bhatta, Remote Sensing and GIS, 2nd Edition, August 2011 | | | | | | |
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| **Related Online Contents** | | | | | | | |
| 1 | | https://onlinecourses.nptel.ac.in/noc19\_ce41/preview | | | | | |
| 2 | | <https://www.coursera.org/lecture/spatial-analysis-satellite-imagery-in-a-gis/what-is-remote-sensing-27nfo> | | | | | |
| 3 | | https://gisgeography.com/remote-sensing-earth-observation-guide/ | | | | | |
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