**M.C.A. Programme**

**Syllabus**

**(With effect from 2025 - 2026)**

**Program Code:**

**DEPARTMENT OF COMPUTER APPLICATIONS**

**Bharathiar University**

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

**21st Rank among Indian Universities in MoE-NIRF)**

**Coimbatore 641 046, INDIA**

**Annexure: I**

**BHARATHIAR UNIVERSITY, COIMBATORE–641 046**

**MASTER OF COMPUTER APPLICATIONS (M.C.A.) 2025-2026**

**(CBCS) - University Department**

**.**

**(Effective from the academic Year 2025-2026)**

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

A pass in Bachelors degree of minimum 3 years duration in BCA, B.Sc. (Computer Science/ Computer Technology/ Information Technology/ Computer System and Design) or equivalent with Mathematics as a course at Higher Secondary level or at Graduate level. The candidate should have appeared for TANCET/ Bharathiar University M.C.A. Entrance Test.

(or)

A pass in any Bachelors degree of minimum 3 years duration with Mathematics or Statistics as any one of the subjects at Graduate level. The candidate should have appeared for TANCET/ Bharathiar University M.C.A. Entrance Test and Bridge Course.

**2. Duration of the Course**

The M.C.A. programme shall be offered on a full-time basis for two years.

**3. Regulations**

The general Regulations of the Bharathiar University Choice Based Credit System Programme are applicable to these programmes. The passing minimum requirements for M.C.A programme is as given below.

Candidates must secure a minimum of 50% marks in total, combining the Continuous Internal Assessment (CIA) and the End Semester Examination (ESE), in each course. For courses that include both theory and practical components, candidates are required to appear for both the theory and practical End Semester Examinations. A minimum of 50% marks must be obtained in aggregate (CIA + ESE) for the course. If a candidate is absent for either the theory or practical component, he/ she has to reappear for both components in order to successfully complete the course.

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

The medium of instruction and Examinations shall be in English.

**5. Syllabus Structure**

The MCA programme will consist of four semesters with three semesters of course work and laboratory work along with one Job Oriented Course (JOC), and one Value Added Course (VAC), one Mini-Project, one Health & Wellness course, and the fourth semester consists of a major project work along with two self-study papers, one JOC, and one VAC.

Table 1: Syllabus structure

|  |  |  |  |
| --- | --- | --- | --- |
| **I Semester** | **II Semester** | **III Semester** | **IV Semester** |
| 5 Core Courses | 4 Core Courses | 4 Core Courses | 2 Self Study Courses |
| 1 Elective Course | 2 Elective Courses | 2 Elective Courses | 1 Major Project |
| 1 Supportive Courses | 1 Job Oriented Course | 1 Mini-Project | 1 Job Oriented Course |
|  | 1 Value Added Course | 1 Health & Wellness Course | 1 Value Added Course |

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.

Students carry out mini-project and major project and the schedule for project review meetings are as given below:

Table 2: Schedule for Project Review Meetings

|  |  |  |
| --- | --- | --- |
|  | First Review | Second Review |
| Mini Project | Second week of July | Second week of August |
| Major Project | First week of February | First week of April |

**6. Ranking**

A candidate who qualifies for the PG Degree Course passing all the Examinations in the first attempt, within the minimum period prescribed for the Course of Study from the date of admission to the Course and secures 1stor2nd Class shall be eligible for ranking and such ranking will be confined to 10% of the total number of candidates qualified in that particular subject to a maximum of 10 ranks.

**7. Revision of Regulations and Curriculum**

The above Regulation and Scheme of Examinations will be in vogue without any change for a minimum period of three years from the date of approval of the Regulations. The University may revise /amend/ change the Regulations and Scheme of Examinations, if found necessary.

**BHARATHIAR UNIVERSITY: COIMBATORE 641046**

**DEPARTMENT OF COMPUTER APPLICATIONS**

**MISSION**

* To impart practical knowledge and professional skills in the area of computer applications to students to make them industry ready.
* To contribute to the advancement of knowledge in the field of Computer Applications through research.
* To involve the students in societal contributions to make them aware of the society and its needs.

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| **Program Educational Objectives (PEOs)** | |
| The PEOs of **M.C.A.** programme describe accomplishments that graduates are expected to attain within five to seven years after graduation | |
| PEO1 | To progress their career productively in software industry, academia, research, entrepreneurial pursuit, government, consulting firms and other Information Technology enabled services. |
| PEO2 | To achieve peer-recognition; as an individual or in a team; by adopting ethics and professionalism and communicate effectively to excel well in cross culture and inter-disciplinary teams. |
| PEO3 | To continue a lifelong professional development in computing that contributes in self and societal growth. |
| PEO4 | To appropriately apply the knowledge of computerapplication areas in modeling software applications for the industries. |
| PEO5 | To assimilate and use state of the art computing technologies, tools and techniques to create systems for solving real world problems. |
| PEO6 | To equip with skill to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social and ethical contexts. |
| PEO7 | To appeal self-learning for continual development as a computer professional for the betterment of individuals, organizations, research community and society. |
| PEO8 | To prepare report and effectively communicate with the stakeholders, about complex computational activities. |
| PEO9 | To understand the need for and prepare themselves to engage in independent and life-long learning in the context of technological advancements. |
| PEO10 | To select suitable ethical principles and commit to professional responsibilities and human values and also contribute value and wealth for the benefit of the society. |

|  |  |
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| **Program Specific Outcomes (PSOs)** | |
| After the successful completion of M.C.A. programme, the students are expected to demonstrate | |
| PSO1 | Ability to design and develop computing systems using concepts of Mathematics, Computer applications and other related disciplines to meet customers’ business objectives. |
| PSO2 | Ability to analyze and formulate solutions with the use of state-of-the-art technologies, skills and models to existing and emerging issues |
| PSO3 | Ability to communicate ideas effectively |
| PSO4 | Ability to demonstrate team work, leadership skills, professional ethics and strong human values. |
| PSO5 | Abilities to face the changing trends and career opportunities in computer application. |
| PSO6 | Ability to update knowledge and skills through lifelong learning. |
| PSO7 | Abilities to understand and align with the prevailing cross cultural, societal, professional, legal and ethical matters in industry. |

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| **Program Outcomes (POs)** | |
| On successful completion of the M.C.A. programme, students will be able to | |
| PO1 | Apply knowledge of mathematics, science and computing appropriately to model the software applications. |
| PO2 | Assimilate and use state of the art computing technologies, tools and techniques necessary for computing practices. |
| PO3 | Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social and ethical contexts |
| PO4 | Have an ability to design, implement and evaluate sustainable computational solutions for various complex problems as per needs and specifications. |
| PO5 | Communicate effectively with the computing community, and with society, about complex computing activities by being able to comprehend and write effective reports, design documentation, and make effective presentations. |
| PO6 | Manage projects and function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| PO7 | Recognize the need for and prepare themselves to engage in independent and life-long learning, engage in self-learning for continual development as a computing professional for the betterment of individuals, organizations, research community and society. |
| PO8 | Apply ethical principles and commit to professional responsibilities and human values. |
| PO9 | Utilize the education necessary to understand the impact of computing solutions in a global and societal context |
| PO10 | Innovate and contribute value and wealth for the benefit of the society. |

## **BHARATHIAR UNIVERSITY, COIMBATORE 641 046**

**M.C.A. (CBCS PATTERN)**

**(University Department)**

*(For the students admitted during the academic year 2025 – 26 onwards)*

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Title of the Course** | **Credi ts** | | **Hours** | | | **Maximum Marks** | | | | |
| **Theory** | **Practical** | | **CIA** | **ESE** | | **Total** | |
| **FIRST SEMESTER** | | | | | | | | | | | |
| 25CSEAC01 | Mathematical Foundation For Computer Applications | 4 | | 4 | - | | 25 | 75 | | 100 | |
| 25CSEAC02 | Data Structures using JAVA | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| 25CSEAC03 | Computer Networks | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| 25CSEAC04 | Advanced DBMS | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| 25CSEAC05 | Software Project Management | 4 | | 4 | - | | 25 | 75 | | 100 | |
| Elective 1 | Elective - I | 4 | | 4 | - | | 25 | 75 | | 100 | |
| Supportive |  | 2 | | 2 |  | | 12 | 38 | | 50 | |
| **Total** | | **26** | |  |  | | **162** | **488** | | **650** | |
| **SECOND SEMESTER** | | | | | | | | | | | |
| 25CSEAC06 | Python Programming | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| 25CSEAC07 | Mobile Application Development | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| 25CSEAC08 | Digital Image Processing | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| 25CSEAC09 | Software Testing with Selenium | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| Elective 2 | Elective – II | 4 | | 4 | - | | 25 | 75 | | 100 | |
| Elective 3 | Elective – III | 4 | | 4 | - | | 25 | 75 | | 100 | |
| **Total** | | **24** | |  |  | | **150** | **450** | | **600** | |
| **THIRD SEMESTER** | | | | | | | | | | | |
| 25CSEAC10 | Web Technologies | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| 25CSEAC11 | Big Data Analytics | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| 25CSEAC12 | Internet of Things | 4 | | 2 | 4 | | 25 | 75 | | 100 | |
| 25CSEAC13 | Cryptography & Information Security | 4 | | 4 | - | | 25 | 75 | | 100 | |
| Elective 4 | Elective – IV | 4 | | 4 | - | | 25 | 75 | | 100 | |
| Elective 5 | Elective – V | 4 | | 4 | - | | 25 | 75 | | 100 | |
| 25CSEAC14 | Mini Project &  Viva- voce | 4 | | 4 | | | 25 | 75 | | 100 | |
| **Total** | | **28** | |  |  | | **175** | **525** | | **700** | |
|  | |  | |  |  | |  |  | |  | |
| **FOURTH SEMESTER** | | | | | | | | | | | |
| 25CSEAC15 | Research Methods in Computer Applications – Self Study 1 | 2 | |  |  | | 50 | - | | 50 | |
| 25CSEAC16 | DevOps & Agile  Methodology – Self Study 2 | 2 | |  |  | | 50 | - | | 50 | |
| 25CSEAC17 | Major Project & Viva-voce | 8 | |  |  | | 50 | 150 | | 200 | |
| **Total** | | **12** | |  |  | | **150** | **150** | | **300** | |
| **Grand Total** | | **90** | |  |  | |  |  | | **2250** | |
| **CO-SCHOLASTIC COURSES** | | | | | | | | | | | |
| Health & Wellness | | 1 | 100 | | | | | | | | |
| **ONLINE COURSES** | | | | | | | | | | | |
| SWAYAM – MOOC – Online Course\* | | 2 | |  |  |  | | |  | | 50 |
| **VALUE ADDED COURSES** | | | | | | | | | | | |
| Value added course 1 | | 2 | |  |  | |  |  | | 50 | |
| Value added course 2 | | 2 | |  |  | |  |  | | 50 | |
| **JOB ORIENTED COURSES** | | | | | | | | | | | |
| Job oriented course 1 | | 2 | |  |  | |  |  | | 50 | |
| Job oriented course 2 | | 2 | |  |  | |  |  | | 50 | |

* \*SWAYAM – MOOC – online course shall be of PG level, with a minimum duration of 4 weeks with minimum 2 credits. The course shall be mandatory and shall be completed within third semester (i.e., before the beginning of fourth semester).
* Health & Wellness course is offered in the third semester.
* Value added course 1 and Job oriented course 1 are offered in the second semester.
* Value added course 2 and Job oriented course 2 are offered in the fourth semester.

**JOB ORIENTED COURSES**

* Robotic Process Automation Design & Development
* Cloud Platforms for Machine Learning
* Introduction To Robotics
* Full Stack Development-1
* Full Stack Development-2
* Design Thinking

**VALUE ADDED COURSES**

* Artificial Intelligence
* Blockchain Technology
* Soft Skills
* Cyber law
* Ethical Hacking
* IOT security
* Universal Human Values
* Emotional Intelligence, Stress management and Social responsibility

**ELECTIVE COURSES**

|  |  |  |  |  |  |  |  |
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| **Course**  **Code** | **Title of the Course** | **Credits** | **Hours** | | **Maximum Marks** | | |
| **Theory** | **Practical** | **CIA** | **ESE** | **Total** |
| **Group I: Networking and Distributed Systems** | | | | | | | |
| 25CSEAE01 | IT Infrastructure and cloud security | 4 | 4 | - | 25 | 75 | 100 |
| 25CSEAE02 | Mobile Networking | 4 | 4 |  | 25 | 75 | 100 |
| 25CSEAE03 | Virtualization and Cloud | 4 | 4 | - | 25 | 75 | 100 |
| **Group II: Database Technologies** | | | | | | | |
| 25CSEAE04 | Data Analysis and  Business Intelligence | 4 | 4 | - | 25 | 75 | 100 |
| 25CSEAE05 | Big Data Frameworks  and Tools | 4 | 2 | 4 | 25 | 75 | 100 |
| 25CSEAE06 | MongoDB Database | 4 | 2 | 4 | 25 | 75 | 100 |
| 25CSEAE07 | Neo 4j Database | 4 | 2 | 4 | 25 | 75 | 100 |
| **Group III: Intelligent Systems** | | | | | | | |
| 25CSEAE08 | Soft Computing | 4 | 4 | - | 25 | 75 | 100 |
| 25CSEAE09 | Intelligent Agents | 4 | 4 | - | 25 | 75 | 100 |
| 25CSEAE10 | Machine Learning | 4 | 2 | 4 | 25 | 75 | 100 |
| 25CSEAE11 | Embedded Systems | 4 | 4 | - | 25 | 75 | 100 |
| **Group IV: Web Technologies** | | | | | | | |
| 25CSEAE12 | Semantic Web | 4 | 4 | - | 25 | 75 | 100 |
| 25CSEAE13 | Service Oriented  Architecture and  Web Services | 4 | 4 | - | 25 | 75 | 100 |
| 25CSEAE14 | Social Media Mining | 4 | 4 | - | 25 | 75 | 100 |
| 25CSEAE15 | Responsive Web  Application | 4 | 2 | 4 | 25 | 75 | 100 |
| 25CSEAE16 | Progressive Web Application Development | 4 | 2 | 4 | 25 | 75 | 100 |
| **Group V: Advanced Programming** | | | | | | | |
| 25CSEAE17 | Open Source Programming | 4 | 2 | 4 | 25 | 75 | 100 |
| 25CSEAE18 | .NET Programming | 4 | 2 | 4 | 25 | 75 | 100 |
| 25CSEAE19 | Graphical  Programming and  Virtual Instrumentation | 4 | 2 | 4 | 25 | 75 | 100 |
| 25CESAE20 | Computer Graphics and Multimedia | 4 | 2 | 4 | 25 | 75 | 100 |
| 25CSEAE21 | Augmented Reality | 4 | 2 | 4 | 25 | 75 | 100 |

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| **Course code** | | | | **25CSEAC01** | | **MATHEMATICAL FOUNDATIONS OF COMPUTER APPLICATIONS** | | | **L** | | | **T** | | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | Core | | | **4** | | | **0** | | **0** | | **4** |
| **Pre-requisite** | | | | | | **Fundamentals of Mathematics** | | | **Syllabus Version** | | | | | | **2.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| 1. To understand the set theory, probability distribution, correlation and regression  2. To analyze mathematical logic and gain an insight on numerical methods  3. To understand the basic concepts of linear algebra and its application to machine learning | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | |
| CO1 | | | To understand the principles of set theory, Probability Distribution and Mathematical Expectation | | | | | | | | | | K1, K2 | | | |
| CO2 | | | To understand the fundamental principles of linear algebra and its application to machine learning | | | | | | | | | | K3 | | | |
| CO3 | | | To understand Correlation models and apply types of correlations | | | | | | | | | | K3 | | | |
| CO4 | | | To understand regression analysis and apply by solving problems | | | | | | | | | | K3, K5 | | | |
| CO5 | | | To design and apply numerical methods in solving problems | | | | | | | | | | K4, K6 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |
| **Unit:1** | | | | | **Set Theory, Probability Distribution and Mathematical Expectation** | | | | | | **18 hours** | | | | | |
| Set Theory: Basic set operations, relations and functions, relation matrices, transitive closure relation, principal of mathematical induction.  Probability Distribution and mathematical Expectation - Random Variable - Probability Distribution a Random Variable - Expectation of Random Variable - Properties of Expected Value and Variance. | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Linear Algebra and its Application for Machine Learning** | | | | | **18 hours** | | | | | | |
| Linear Algebra: Systems of Linear Equations – Matrices – Solving Systems of Linear Equations – Vector Spaces – Linear Mappings – Matrix Decompositions: Determinant and Trace – Eigenvalues and Eigenvectors – Eigendecomposition and Diagonalization – Singular Value Decomposition – When Models Meet Data: Data, Models and Learning | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Correlation** | | | **16 hours** | | | | | | | | |
| Introduction to Correlation - Definition of Correlation- Scatter Diagram- Kari Pearson’s Coefficient of Linear Correlation- Coefficient of Correlation and Probable Error of r- Coefficient of Determination - Merits and Limitations of Coefficient of Correlation- Spearman’s Rank Correlation. | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **Regression Analysis** | | | **18 hours** | | | | | | | | |
| Regression Analysis – Regression - Difference between Correlation and Regression Analysis- Linear Regression Equations -Least Square Method- Regression Lines- Properties of Regression Coefficients- Standard Error of Estimate. | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Numerical Methods** | | **20 hours** | | | | | | | | | |
| Numerical Methods: Finding Roots, Bisection, Regula-Falsi, Newton Raphson Methods, Solutions of Simultaneous Linear Equations, Gaussian Elimination, Gauss - Siedal Methods. | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | |
| 1 | Douglas Cenzer, Jean Larson, Christopher Porter, Jindrich Zapletal, “Set Theory and Foundations of Mathematics”, WSPC (February 4, 2022) | | | | | | | | | | | | | | | |
| 2 | K.L.Sehgal, “Quantitative Techniques and Statistics”, First Edition, Himalaya Publishing House, 2011. | | | | | | | | | | | | | | | |
| 3 | Abdelwahab Kharab and Ronald Guenther, “An Introduction to Numerical Methods”, CRC Press; 4th edition (June 30, 2021) | | | | | | | | | | | | | | | |
| 4 | Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, ‘Mathematics for Machine Learning’, Cambridge University Press (April 2020) | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | |
| 1 | Charles E. Roberts, Jr, “Introduction to Mathematical Proofs A Transition to Advanced Mathematics” Denny Gulick, 4th Edition, Published by Pearson, ISBN: 9780134746753, 2018. | | | | | | | | | | | | | | | |
| 2 | John R. Hauser, “Numerical Methods for Nonlinear Engineering Models”, Springer Netherlands, ISBN: 9401777071, 9789401777070, 1013 pages, 2017. | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | Advanced Probability Theory - Swayam | | | | | | | | | | | | | | |
| 2 | | Discrete Mathematics - Swayam | | | | | | | | | | | | | | |
| **Course Designed By: Mr.S.Palanisamy, Dr. T. Amudha, Dr. R. Rajeswari** | | | | | | | | | | | | | | | | |

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

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

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **Course code** | | | | **25CSEAC02** | **DATA STRUCTURES USING JAVA** | | | **L** | | | | **T** | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | Core | | | **2** | | | | **0** | **2** | | **4** |
| **Pre-requisite** | | | | | Basic knowledge of Data Structures and  Core Java Programming | | | **Syllabus Version** | | | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To understand and implement data structures in Java 2. To understand the Java Collections and GUI Framework 3. 3. To Practice GUI programming and Database Connectivity   4. To develop Web based applications using JSP and Java Servlets | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | |
| 1 | | | To understand and implement data structures in Java | | | | | | | | K2, K3 | | | | |
| 2 | | | To understand Collections and GUI in Java Framework | | | | | | | | K1,K2 | | | | |
| 3 | | | To Practice GUI using Java to demonstrate the operations on collections | | | | | | | | K2,K3,K6 | | | | |
| 4 | | | To create database connectivity using JDBC | | | | | | | | K3,K5,K6 | | | | |
| 5 | | | To Develop a web application using JSP | | | | | | | | K2,K3 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Unit:1** | | | | **Data Structures** | | | | | | **10 hours** | | | | | |
| Functions – Comparing Growth Rates -  Asymptotic Analysis – Arrays – Singly Linked List – Circularly Linked List – Stack – Queues – List Abstract Data Type (ADT) – Iterators – Tree ADT – Binary Trees – Tree Traversal Algorithms – Binary Search Trees – AVL Trees. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Unit:2** | | | | **Graphs and Sorting** | | | | | **16 hours** | | | | | | |
| Graphs: Graph ADT – Data Structures for Graphs – Graph Traversals – Directed Acyclic Graphs – Shortest Paths – Minimum Spanning Tree - Sorting: Merge Sort – Quick Sort – Selection Sort. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Unit:3** | | | | **Introduction to Collection and Swing Framework** | | | **15 hours** | | | | | | | | |
| Collections Framework: Collection classes and Interfaces – Legacy classes – Date – Calendar – Time Zone. Event Handling: Exploring Swing – JFrame – JComponent – Text Fields – Buttons – Combo boxes – Application design using Swing components. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Unit:4** | | | | **Database Connectivity with JDBC** | | | **24 hours** | | | | | | | | |
| Database Programming in Java: Overview of the JDBC Process - JDBC Concepts - JDBC Drivers – Database Connection - Statement Objects – The Connection Interface – Result Set – Interacting with the database - Transaction Processing. | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Unit:5** | | | | **Web application Development using Java Servlets** | | **25 hours** | | | | | | | | | |
| Java Servlets: Initialization–Deployment–Reading Client Data–Reading HTTP Request Headers – Cookies - Session Tracking – Database Connections. Java Server Pages (JSP) - JSP tags - Components of a JSP page - Expressions–Scriptlets – Directives – Declarations - Working with JSP- JSP and JDBC- JQuery – AJAX - Application Development Environment: Overview of MVC architecture | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | |
|  | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | | |
|  | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | |
| 1 | Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser, “Data Structures and Algorithms in Java”, Wiley, 2014. | | | | | | | | | | | | | | |
| 2 | Herbert Schildt, “The Complete Reference Java”, Tata McGrawHill Publishing Company Ltd, 2012 | | | | | | | | | | | | | | |
| 3 | Marty Hall, Larry Brown, Yaakov Chaikin, “Core Servlets and Java Server pages”: Volume 2 – Advanced Technologies, II edition, Pearson education, 2008. | | | | | | | | | | | | | | |
| 4 | Jamie Jaworskie,”Java 2 Platform Unleashed”, Techmedia SAMS, IV edition, 2008. | | | | | | | | | | | | | | |
| 5 | Craig Walls, “Spring in Action”, IV edition, Manning Publications, 2015. | | | | | | | | | | | | | | |
| 6 | <https://docs.oracle.com> | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | |
| 1 | | Programming in Java <https://nptel.ac.in/courses/106/105/106105191/> | | | | | | | | | | | | | |
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| Course Designed By: Mr**. S. Palanisamy** | | | | | | | | | | | | | | | |

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

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| **Course code** | | | | **25CSEAC03** | **COMPUTER NETWORKS** | | | **L** | | | | **T** | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | Core | | | **2** | | | | **0** | **2** | | **4** |
| **Pre-requisite** | | | | | Basics of networks | | | **Syllabus Version** | | | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To understand the functionality of networks protocols and layers 2. To understand network simulation | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | |
| 1 | | | To describe the network concepts and explain the reference models of networks | | | | | | | | K1, K2 | | | | |
| 2 | | | To discuss on the Data transfer and access protocol. | | | | | | | | K3 | | | | |
| 3 | | | To examine the network layer protocols and its algorithm | | | | | | | | K4, K6 | | | | |
| 4 | | | To examine the Transport layer protocols and its algorithm | | | | | | | | K4, K5 | | | | |
| 5 | | | To analyze the issues in application layer | | | | | | | | K5 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | **Introduction to Networks** | | | | | | **18 hours** | | | | | |
| Introduction to Networks & Communication Media: Uses –Network hardware–Network software–Reference Models–Example Networks: Internet–X.25-ATM-Transmission media–Wireless Transmission–Telephone system–ISDN, ATM communication –Satellite communication. | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | **Data Transfer and Access** | | | | | **16 hours** | | | | | | |
| Data Transfer & Access Protocols: Error detection and correction methods–Elementary protocols –Sliding window protocols -IEEE 802.2 Logical Link Control – Bluetooth: architecture–protocol stack–radio layer–baseband layer–L2CAP layer–frame structure. | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | **Network Layer** | | | **18 hours** | | | | | | | | |
| Network Layer Protocols: Routing algorithms Congestion control: Principles –policies–Congestion control in VC subnets –congestion control in datagram subnets-Network layer in Internet: Architecture– IP protocol -IP Address – IPv6. | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | **Transport Layer** | | | **18 hours** | | | | | | | | |
| TRANSPORT PROTOCOLS: Transport service – Transport protocols – Transport protocols in Internet: TCP and UDP | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | **Application Layer** | | **20 hours** | | | | | | | | | |
| APPLICATION LAYER ISSUES: Domain Name System –Electronic Mail. Network Simulator: Basics of Computer Network Simulation –Introduction to Network Simulator –Basic Architecture–Installation–Directories and Convention–Running Network Simulation–Simulation Examples | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | |
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|  | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | | |
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| **Text Books** | | | | | | | | | | | | | | | |
| 1 | Andrew S. Tanenbaum, “Computer Networks”, PHI, 5th Edition, 2013 | | | | | | | | | | | | | | |
| 2 | Behrouz A. Forouzan, “Data communication and Networking”, TataMcGrawHill,4thEdition,2006 | | | | | | | | | | | | | | |
| 3 | Teerawat Ussaruyakul, Ekram Hossain, Introduction to Network Simulator NS2, Springer, 2009 | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | |
| 1. William Stallings, “Data and Computer Communication”,7th Edition, Pearson Education, 2007. | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | |
| 1 | | Computer networks, <https://nptel.ac.in/courses/106/106/106106091/> | | | | | | | | | | | | | |
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| Course Designed By:**Dr. J. Satheesh Kumar** | | | | | | | | | | | | | | | |

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

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| **Course code** | | | | | | **25CSEAC04** | | | **ADVANCED DBMS** | | | | | **L** | | | | | **T** | | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | | | | **Core** | | | | | **4** | | | | | **0** | | **2** | | **4** |
| **Pre-requisite** | | | | | | | | | **Nil** | | | | | **Syllabus Version** | | | | | **1.0** | | | | |
| **Course Objectives:**   1. To understand the basics of relational database systems, normalization, SQL and transaction management 2. To understand fundamental concepts and challenges in parallel and distributed database systems 3. To understand the basics of document, mobile and graph databases and apply them in real-world scenarios | | | | | | | | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | Understand the fundamentals of relational database systems | | | | | | | | | | | | | | | K1,K2 | | | | |
| 2 | | | | Understand and write SQL queries for a given context in relational database systems | | | | | | | | | | | | | | | K1,K2, K6 | | | | |
| 3 | | | | Understand the fundamental concepts and challenges in parallel and distributed database systems | | | | | | | | | | | | | | | K3,K4 | | | | |
| 4 | | | | Understand the basic concepts of document databases such as XML and JSON and mobile databases | | | | | | | | | | | | | | | K2,K3 | | | | |
| 5 | | | | Understand the fundamentals of graph and column database systems and their architectures | | | | | | | | | | | | | | | K2,K3 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit: 1** | | | | | | **Overview of DBMS** | | | | | | | | | | | | **18-- hours** | | | | | |
| Introduction: Purpose of Database Systems – Database Languages – Database Design – Database and Application Architecture– Relational Database Design: E-R Model – Decomposition using Functional Dependencies – Normal Forms – Functional Dependencies – Multivalued Dependencies – Database Design Process – Transaction Management: Transaction Concept – Transaction Model – Transaction Atomicity and Durability – Transaction Isolation – Serializability – Deadlock Handling | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | | **SQL** | | | | | | | | | | | **18-- hours** | | | | | | |
| Introduction: SQL Data Definition – Basic Structures of SQL Queries – Advanced Basic Operations – Set Operations – Null Values – Aggregate Functions – Nested Subqueries – Modification of the database – Intermediate SQL: Join Expressions – Views – Transactions – Integrity Constraints – SQL Data Types and Schemas – Index Definition in SQL - Authorization – Advanced SQL: Accessing SQL from a Programming Language – Functions and Procedures – Triggers – Recursive Queries – Advanced Aggregation Features | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | | **Parallel and Distributed Databases** | | | | | | | | | | | | | **18-- hours** | | | | |
| Database-System Architectures: Server System Architectures – Parallel Systems – Distributed Systems – Transaction Processing in Parallel and Distributed Systems – Cloud-Based Services –Parallel and Distributed Transaction Processing: Distributed Transactions – Commit Protocols – Concurrency Control in Distributed Databases – Replication – MongoDB Sharing and Replication: Sharding Mechanisms – Cluster Balancing – Replication – Write Concern and Read Preference – Cassandra: Consistent Hashing – Replicas - Snitches | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | | **Document and Mobile Databases** | | | | | | | | | | | | | **18-- hours** | | | | |
| Semistuctured Data and XML: Introduction – DTDs – DOM and SAX Interfaces – Namespaces – XSL and XSLT – XPath – SOAP – WSDL - UDDI - JSON Document Databases – XML Schema: Resource Description Framework (RDF) – XML Query Languages: XQuery – XML Information Set – XQuery and XPath Data Model (XDM) – Formal Semantics – XML and Databases: Storing XML in Databases – XML and SQL Native XML Databases Introduction to Mobile Databases: Mobile DBMs – Issues with Mobile DBMs | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | | **Graph and Column Databases** | | | | | | | | | | | | | **18-- hours** | | | | |
| Graph Databases: Introduction – RDBMS Patterns for Graphs – RDF and SPARQL – Property Graphs and Neo4j – Graph Database Internals – Graph Compute Engine - Column Databases: Data Warehousing Schemas – The Columnar Alternative – Sybase IQ, C-Store and Vertica – Column Database Architectures | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | | **Contemporary Issues** | | | | | | | | | | | | | **2-- hours** | | | | |
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| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | **Total Lecture hours** | | | | | | | | | | | | | **92-- hours** | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Abraham Silberchatz, Henry K.Forth, Sudharshan, **“**Database system Concepts**”**, 7th edition, McGraw Hill, 2020. (Unit:1 – 3) | | | | | | | | | | | | | | | | | | | | | |
| 2 | | Thomas Connolly and Carolyn Begg, “Database Systems: A Practical Approach to Design, Implementation and Management”, 6th Edition, Pearson Education, 2015. (Unit: 4) | | | | | | | | | | | | | | | | | | | | | |
| 3 | | Guy Harrison, “Next Generation Databases: NoSQL and Big Data”, Apress, 2015 (Unit: 3, 5) | | | | | | | | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education, 2017 | | | | | | | | | | | | | | | | | | | | | |
| 2 | | Rini Chakrabarti, Shilbhadra Dasgupta, “Advanced Database Management System”, DreamTech Press, 2014. | | | | | | | | | | | | | | | | | | | | | |
| 3 | | Ted Hills, “NoSQL and SQL Data Modeling”, 1st Edition, Technics Publications, 2016 | | | | | | | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | Database Management System, <https://nptel.ac.in/courses/106105175> | | | | | | | | | | | | | | | | | | | | |
| 2 | | | Fundamentals of Database Systems, <https://nptel.ac.in/courses/106104135> | | | | | | | | | | | | | | | | | | | | |
| 3 | | | Create Your First NoSQL Database with MongoDB and Compass, <https://www.coursera.org/projects/nosql-database-with-mongodb-and-compass> | | | | | | | | | | | | | | | | | | | | |
| Course Designed By: **Dr.R.Rajeswari** | | | | | | | | | | | | | | | | | | | | | | | |
| **Mapping with Programme Outcomes** | | | | | | | | | | | | | | | | | | | | |
| **COs** | | | | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | | **PO8** | **PO9** | | | | **PO10** | |
| **CO1** | | | | S | | M | M | | S | M | M | M | | M | L | | | | S | |
| **CO2** | | | | S | | M | M | | S | M | M | L | | M | L | | | | M | |
| **CO3** | | | | S | | M | M | | S | M | M | L | | M | L | | | | M | |
| **CO4** | | | | S | | M | S | | S | M | S | L | | M | L | | | | S | |
| **CO5** | | | | S | | M | S | | M | M | M | M | | M | L | | | | S | |

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

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| **Course code** | | | | | | **25CSEAC05** | | | | **SOFTWARE PROJECT MANAGEMENT** | | | | | | | | | **L** | | | **T** | | | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | | | | | Elective | | | | | | | | | **4** | | | **0** | | | **0** | | **4** |
| **Pre-requisite** | | | | | | | | | | **Nil** | | | | | | | | | **Syllabus Version** | | | | | **1** | | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To learn software planning, project management, activity planning 2. To analyze and apply effort and cost estimation techniques 3. To learn Monitoring, scheduling and Risk Management 4. To Evaluate Modern techniques for project management 5. To apply Software project Management concept in a case study using tools | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | Remember Software Process Models | | | | | | | | | | | | | | | | | | | | | K2 | | |
| 2 | | | | Understand steps involved in Software Project Management | | | | | | | | | | | | | | | | | | | | | K2 | | |
| 3 | | | | Apply and Analyze Software effort Estimation Methods | | | | | | | | | | | | | | | | | | | | | K2 | | |
| 4 | | | | Apply and Evaluate Software Project Management Tools | | | | | | | | | | | | | | | | | | | | | K2 | | |
| 5 | | | | Understand the Activity Planning, Risk Management using case studies | | | | | | | | | | | | | | | | | | | | | K3 | | |
| 6 | | | | Learn the modern techniques in Software Project Management like Agile, Scrum, DevOps | | | | | | | | | | | | | | | | | | | | | K2 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | | | **Introduction to Software Project Management** | | | | | | | | | | | | | | **12 hours** | | | | | | |
| Definition of Software Engineering – Software Process Models – Agile Process Models. Introduction to Software Project Management- Software project versus other types of project- Activities – Management - Stakeholders- Requirement Specification – Information and control in organizations - step wise project -Project evaluation. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | | | **Selection of Appropriate Project Approach** | | | | | | | | | | | | | **10 hours** | | | | | | | |
| Software Process Models: Agile (introduction, Why Agile, What is Agile), SCRUM, Enhancers - Choice of Process Model – Selecting the most appropriate Process model – Software Effort Estimation - Activity Planning – Network Planning Models – Forward Pass - Backward Pass – Critical path - Float – Precedence Networks | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | | | **Risk Management** | | | | | | | | | | | **14 hours** | | | | | | | | | |
| Nature of risk- Managing Risks- Risk Identification-Risk Analysis –Reducing Risks- Evaluating Risks- z values. - Monitoring and control- creating the frame work- collecting the data- visualizing the progress- cost monitoring- earned value- prioritizing, monitoring-Change control.Software quality –importance. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | | | **Introduction to Devops** | | | | | | | | | | | **12 hours** | | | | | | | | | |
| Define Devops - What is Devops - SDLC models, Lean, ITIL, - Why Devops - History of Devops - Devops Stakeholders - Devops Goals - Important terminology - Devops perspective - Devops and Agile - Devops Tools - Configuration management - Continuous Integration and Deployment. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | | | **Software Tools** | | | | | | | | | | **12 hours** | | | | | | | | | | |
| Software Tools for SDLC-Software tools for Project Planning, Scheduling and reporting, Resource Management. Case Studies: Applications of SPM concepts in Hospitals, Library, Inventory, Marketing (For Unit Case studies, students are expected to apply SPM tools and submit a report) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | | | **Contemporary Issues** | | | | | | | | | | **2 hours** | | | | | | | | | | |
| Submit an assignment on Learning and Unlearning concept in software industry | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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|  | | | | | | | **Total Lecture hours** | | | | | | | | | | **62 hours** | | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Mike Cotterell, Bob Hughes, “Software Project Management”,Inclination/Thomas Computer Press,1995. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | Robert K. Wysocki “Effective Software Project Management” – WileyPublication,2011. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | Walker Royce: “Software Project Management”- Addison-Wesley,1998. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 Andrew Stellmen&Greene Jennifer, “Learning Agile”, Mary Treaseler 2014 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Gopalaswamy Ramesh, “Managing Global Software Projects” – McGraw Hill Education (India), Fourteenth Reprint2013. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | Darrel Ince, H.Sharp and M.Woodman, “Introduction to Software Project Managementand Quality Assurance”, Tata McGraw Hill,1995. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 Ramesh Gopalasamy, “Managing Global Software Projects”, Tata McGraw-Hill-2005 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 Joseph Joyner, “DevOps for Beginners”,MihailsKonoplovs, 2015 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | www.coursera.com | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | [www.edx.org](http://www.edx.org) | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | [www.simplilearn.com](http://www.simplilearn.com) | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | [www.udemy.com](http://www.udemy.com) | | | | | | | | | | | | | | | | | | | | | | | | |
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| Web Link   1. <https://www.atlassian.com/> 2. <https://www.scoro.com/blog/best-project-management-software-list/> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Course Designed By: Dr. M Punithavalli | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Mapping with Programme Outcomes** | | | | | | | | | | | | | | | | | | | | | | | | |
| **COs** | | | | **PO1** | | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | | | | | | | **PO10** | | |
| **CO1** | | | | - | | | M | L | | L | M | L | L | M | L | | | | | | | M | | |
| **CO2** | | | | L | | | M | M | | M | M | M | M | M | L | | | | | | | M | | |
| **CO3** | | | | M | | | M | L | | - | L | - | - | M | L | | | | | | | L | | |
| **CO4** | | | | - | | | M | M | | M | M | M | M | M | L | | | | | | | M | | |
| CO5 | | | | L | | | S | M | | S | S | M | M | S | S | | | | | | | S | | |
| CO6 | | | | L | | | L | - | | - | L | - | - | L | M | | | | | | | L | | |

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

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| **Course code** | | | | **25CSEAC06** | **PYTHON PROGRAMMING** | **L** | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | | **Core** | **4** | | | **0** | **2** | **4** |
| **Pre-requisite** | | | | | **Nil** | **Syllabus Version** | | | **1.0** | | |
| **Course Objectives:**   1. To understand the basics of Python data types and programming constructs 2. To understand and apply python libraries for data science and natural language processing 3. To understand and develop web applications using Flask and React | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | | Understand and represent data using programming structures such as lists, dictionaries, tuples, sets and strings | | | | | | K1,K2 | | |
| 2 | | | Understand and develop programs using control structures and functions | | | | | | K1,K2, K6 | | |
| 3 | | | Understand and develop programs using object oriented concepts and files | | | | | | K3,K4 | | |
| 4 | | | Understand and develop data science and NLP applications using various libraries | | | | | | K3,K4,K5 | | |
| 5 | | | Develop web applications using Flask, React and PostgreSQL | | | | | | K2,K3, K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | |
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| **Unit: 1** | | | | **Introduction** | | | | **18-- hours** | | | |
| Introduction to Python Programming: Introduction; Variables and Assignment Statements; Arithmetic Operators; Single-, Double- and Triple-Quoted Strings; print function; Getting Input from User; Comparison Operators – Strings: Formatting Strings; Basic String Operations; Regular Expressions - Sequences: Lists; Tuples; Unpacking Sequences; Sequence Slicing; del Statement; Searching Sequences; List Comprehensions; Filter, Map and Reduce – Dictionaries: Creating a Dictionary; Iterating through a Dictionary; Basic Dictionary Operations; Dictionary Methods keys and values; Dictionary Comparisons; Dictionary Comprehensions – Sets: Comparing Sets; Mathematical Set Operations; Mutable Set Operators and Methods; Set Comprehensions | | | | | | | | | | | |
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| **Unit:2** | | | | **Control Statements and Functions** | | | **18-- hours** | | | | |
| Control Statements: if Statement – if…else and if…elif…else Statements; while Statement; for Statement; Augmented Assignments; Sequence Controlled Iteration; Formatted Strings; Sentinel Controlled Iteration; break and continue Statements; Boolean Operators and, or and not – Functions: Defining Functions; Functions with Multiple Parameters; Random-Number Generation; Python Standard Library; math Module Functions; Default Parameter Values; Keyword Arguments; Arbitrary Argument Lists; Methods; Scope Rules; import; Passing Arguments to Functions; Recursion | | | | | | | | | | | |
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| **Unit:3** | | | | **Object Oriented Programming; Files and Exceptions** | | | | | **18-- hours** | | |
| Object-Oriented Programming: Classes; Controlling Access to Attributes; Properties for Data Access; Inheritance; Polymorphism; Operator Overloading; Namespaces and Scopes; Files: Text File Processing; Updating Text Files; Serialization with JSON; pickle Serialization and Deserialization; Working with CSV Files; Python Standard Library Module csv – Exceptions: Handing Exceptions; Division by Zero and Invalid Input; try Statements; Catching Multiple Exceptions; finally Clause; Explicitly Raising an Exception | | | | | | | | | | | |
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| **Unit:4** | | | | **Python Libraries for Data Science and NLP** | | | | | **18-- hours** | | |
| NumPy: Introduction; Creating Arrays; Array Attributes; Filling Arrays with Specific Values; Creating arrays from Ranges; array Operators; NumPy Calculation Methods; Universal Functions; Indexing and Slicing; reshaping and Transposing; Pandas: Pandas Series; Pandas DataFrames; Reading CSV Files into Pandas DataFrames – Basic Descriptive Statistics – Data Visualization: matplotlib; seaborn; bar graph; scatter plot; contour plot; pie graph; TensorFlow: Tensors; TensorFlow Datasets; Classification; Regression – Natural Language Processing (NLP): TextBlob; Tokenizing; Parts-of-Speech Tagging; Spell Checking and Correction; Stemming and Lemmatization; Word Frequencies; n-grams | | | | | | | | | | | |
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| **Unit:5** | | | | **Web Applications using Flask, React and PostgreSQL** | | | | | **18-- hours** | | |
| Introduction: Full Stack Development; Flask React and PostgreSQL (FRAP) Applications; Shell; Editor; Package Manager; In-Browser Tools – Client-Side Pages with React: Why React; Initial React App; Working with Fronts; Creating Input Elements; Controlled Inputs; Global State – Server-Side API Creation with Flask: Conventions for REST APIs – Preparing the Virtual Environment – Python Flask Servers – Managing the Configurations – Creating Scripts – Database Creation: Using PostgreSQL through SQLAlchemy; CRUD Operations on a PostgreSQL database | | | | | | | | | | | |
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| **Unit:6** | | | | **Contemporary Issues** | | | | | **2-- hours** | | |
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| Analyze Data to understand Global Issues on health care, pandemic situations | | | | | | | | | | | |
|  | | | | **Total Lecture hours** | | | | | **92-- hours** | | |
| **Text Book(s)** | | | | | | | | | | | |
| 1 | Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2019. (Units: 1 - 4) | | | | | | | | | | |
| 2 | Erik M. Ferragut, “Quick Start Full Stack Web Development: Build Secure Asynchronous Single-Page Apps with Flask, React, and PostgreSQL”, Independently Published, 2020. (Unit:5) | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | |
| 1 | Wesley J. Chun , “Core Python Programming”, Pearson Education, 2nd Edition, 2016. | | | | | | | | | | |
| 2 | Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, 4th Edition, 2018. | | | | | | | | | | |
| 3 | Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016 | | | | | | | | | | |
| 4 | Sebastian Raschka and Vahid Mirjalili,, Python Machine Learning”, 2nd Edition, Packt Publishing, 2017. | | | | | | | | | | |
| 5 | Miguel Grinberg, “Flask Web Development: Developing Web Applications with Python”, O’Reilly, 1st Edition, 2014. | | | | | | | | | | |
| 6 | John Sheehan, “React to Python: Creating React Front-End Web Applications with Python”, JennaSys, 1st Edition, 2021. | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
| 1 | | PYTHON - A to Z Full Course for Beginners, <https://www.udemy.com/> | | | | | | | | | |
| 2 | | Python for Data Science, <https://swayam.gov.in/> | | | | | | | | | |
| 3 | | Python for Data Science and Machine Learning Bootcamp, <https://www.udemy.com/> | | | | | | | | | |
| 4 | | Introduction to Python Programming, <https://www.udacity.com/> | | | | | | | | | |
| Course Designed By: **Dr.R.Rajeswari** | | | | | | | | | | | |

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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 | S | S | S | S | S |
| **CO2** | S | M | S | S | M | S | M | S | S | M |
| **CO3** | S | S | S | S | S | S | S | M | S | S |
| **CO4** | S | S | S | S | S | S | S | S | S | M |
| **CO5** | S | S | M | S | M | S | S | S | S | M |

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

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| **Course code** | | | | **25CSEAC07** | **MOBILE APPLICATION DEVELOPMENT** | | | **L** | | | | **T** | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | Core | | | **2** | | | | **0** | **2** | | **4** |
| **Pre-requisite** | | | | | Java Programming | | | **Syllabus Version** | | | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To understand basics of the Mobile Technology 2. To understand Android Stack, API, UI, and SQLite database 3. To develop Android Applications and Publishing | | | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | |
| 1 | | | To understand Mobile Technologies: OSS, OHA, Android and iOS | | | | | | | | K2 | | | | |
| 2 | | | To understand Android Architecture, Stack and App Life Cycle Model | | | | | | | | K2 | | | | |
| 3 | | | To discuss android APIs and development components | | | | | | | | K2 | | | | |
| 4 | | | To develop android application using UI components | | | | | | | | K3,K5,K6 | | | | |
| 5 | | | To understand SQLite operations and publishing the application | | | | | | | | K2,K3,K6 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | **Introduction to OSS, OHA and Mobile Technologies** | | | | | | **10 hours** | | | | | |
| Introduction to Mobile Applications: Native and web applications - Mobile OS and Databases. Introduction to Android: History - Features – OSS – OHA - Versions - Android devices - Setting up software – IDE – XML -User interface - Using Wifi – marketplace. | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | **Android Architecture and Activity Lifecycle** | | | | | **16 hours** | | | | | | |
| Android Architecture: Android Stack - Linux Kernel - Android Runtime - Application Framework - Android emulator - Android applications development -Virtualization – APIs – Android File system – A Basic Android Application - Deployment. Android Activities: The Activity Lifecycle – Lifecycle methods – Creating Activity. | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | **Android Application Component and APIs** | | | **15 hours** | | | | | | | | |
| Intents – Intent Filters – Activity stack. Android Services: Simple services – Binding and Querying the service – Executing services. Broadcast Receivers: Creating and managing receivers – Receiver intents. Content Providers: Creating and using content providers – Content resolver. | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | **Android UI layouts and controls** | | | **24 hours** | | | | | | | | |
| Android UI - Android Layouts – Attributes – Layout styles - Linear – Relative – Table – Grid – Frame – Menus - Lists and Notifications - Input Controls: Buttons - Text Fields – Checkboxes - alert dialogs – Spinners - rating bar - progress bar. | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | **DB Connectivity and Publishing Applications** | | **25 hours** | | | | | | | | | |
| Working with databases: SQLite – coding for SQLite using Android – Interacting with Firebase -Publishing and Internationalizing mobile applications - mobile application deployment: Game App, Health App – E commerce app – other apps. | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | |
|  | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | |
| 1 | Barry Burd, John Paul Mueller, “Android Application Development – All-in-one for Dummies”, 3rd Edition, Wiley India, 2021. | | | | | | | | | | | | | | |
| 2 | John Horton, Android Programming for Beginners, 3rd Edition, Packt Publishing, 2021. | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | |
| 1 | | <http://www.developer.android.com> | | | | | | | | | | | | | |
| 2 | | https://www.sqlite.org/ | | | | | | | | | | | | | |
| 3 | | <https://onlinecourses.swayam2.ac.in/aic20_sp02/preview> | | | | | | | | | | | | | |
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| Course Designed By: **Dr.T.Amudha** | | | | | | | | | | | | | | | |

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

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| **Course code** | | | | **25CSEAC08** | | **DIGITAL IMAGE PROCESSING** | | | **L** | | | **T** | | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | Core | | | **2** | | | **0** | | **2** | | **4** |
| **Pre-requisite** | | | | | | Fundamentals of linear algebra, probability theory and applied discrete mathematics | | | **Syllabus Version** | | | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| The main objectives of the course are to   1. Study the fundamentals of digital image processing 2. Learn the image processing operations such as image enhancement, restoration and segmentation 3. Understand the methods used for object recognition | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | |
| CO1 | | | Understand the Fundamentals of Digital Image Processing | | | | | | | | | | K1, K2 | | | |
| CO2 | | | Understand the Image Processing Toolbox in MATLAB | | | | | | | | | | K1, K2 | | | |
| CO3 | | | Understand and Implement Intensity Transforms and Image Restoration using Spatial and Frequency Domain Filters | | | | | | | | | | K2, K3 | | | |
| CO4 | | | Understand and Apply Morphological Image Processing and Image Segmentation | | | | | | | | | | K2, K3 | | | |
| CO5 | | | Design and Implement Object Recognition Methods | | | | | | | | | | K5,K6 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Introduction to Image Processing** | | | | | | **16 hours** | | | | | |
| Introduction: Fundamental Steps in Image processing – Components of an Image Processing System – Digital Image Fundamentals: Image Sensing and Acquisition – Image Sampling and Quantization – Pixels – Distance measures – Mathematical methods: Arrays Vs Matrix Operations – Linear Vs Non linear operations – arithmetic operations - set and logical operations – spatial operations | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **MATLAB for Image Processing** | | | | | **16 hours** | | | | | | |
| MATLAB Working Environment – Reading, Displaying and Writing Images – Data Classes – Image Types – Converting between Data Classes and Image Types – Array Indexing – Standard Arrays – M-Function Programming: M-Files – Operators – Flow Control – Code Optimization – Interactive I/O – Cell Arrays and Structures | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Image Filtering** | | | **20 hours** | | | | | | | | |
| Intensity Transformations and Spatial Filtering: Intensity Transformation Functions – Histogram Processing – Spatial Filtering – Standard Spatial Filters – smoothing filters - Sharpening Filters – Combining spatial enhancement methods. Frequency Domain filters: Discrete Fourier Transform : one variable – Frequency Domain Filters for smoothing - Sharpening Frequency Domain Filters | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **Restoration,** **Morphological Image Processing and Image Segmentation** | | | **18 hours** | | | | | | | | |
| Image Restoration: Noise Models – Restoration by Spatial Filtering: mean filter, order statistic filter, adaptive filter - Morphological Image Processing: Preliminaries – Dilation and Erosion – opening and closing – morphological algorithms - Image Segmentation: Point, Line and Edge Detection – Line Detection using the Hough Transform – Thresholding : global thresholding, Otsu’s method– Multiple Threshold | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Representation and Object Recognition** | | **20 hours** | | | | | | | | | |
| Representation and Description: Representation – Boundary Descriptors – Regional Descriptions –– Object Recognition: patterns and classes, Recognition based on Decision-Theoretic Methods: Pattern Matching using Minimum-Distance Classifiers – Matching by Correlation. | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | |
| 1 | Rafael C. Gonzalez and Richard E. Woods, ‘Digital Image Processing’, Pearson Education, 2018. | | | | | | | | | | | | | | | |
| 2 | Rafael C. Gonzalez, Richard E. Woods and Steven L. Eddins, ‘Digital Image Processing using MATLAB’, Pearson Education, 2005. | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | |
| 1 | Scott E Umbaugh, ‘Digital Image Processing and Analysis: Applications with MATLAB and CVIP Tools’, CRC Press, Third Edition, 2017. | | | | | | | | | | | | | | | |
| 2 | Anil K. Jain, ‘Fundamentals of Digital Image Processing’, Prentice Hall Learning Private Limited, 1994. | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | Digital Image Processing, <https://nptel.ac.in/courses/117/105/117105079/> | | | | | | | | | | | | | | |
| 2 | | Fundamentals of Digital Image and Video Processing, <https://www.coursera.org/learn/digital> | | | | | | | | | | | | | | |
| **Course Designed By: Dr. J. Satheeshkumar** | | | | | | | | | | | | | | | | |

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

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

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| **Course code** | | | | **25CSEAC09** | | | **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING** | | | | | | | **L** | | | **T** | | **P** | | **C** | |
| **Core/Elective/Supportive** | | | | | | | **Elective** | | | | | | | **2** | | |  | | **2** | | **4** | |
| **Pre-requisite** | | | | | | | **Basics of Mathematical Probabilities and Computer Programming** | | | | | | | **Syllabus Version** | | | | | **2025-2026** | | | |
| **Course Objectives:**   1. To articulate key problems, both technical and philosophical, in the development of artificial intelligence 2. To apply the machine learning algorithms for various applications. 3. To understand the Concepts of Machine learning algorithms of different probabilistic Approaches | | | | | | | | | | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | |
| CO1 | Understand and Apply AI technique in the development of problem- solving and learning systems | | | | | | | | | | | | | | | | | | | | | K1 |
| CO2 | Understand the problems where artificial intelligence techniques are applicable | | | | | | | | | | | | | | | | | | | | | K2 |
| CO3 | Apply the concepts of machine learning | | | | | | | | | | | | | | | | | | | | | K2 |
| CO4 | Understand the theoretical concepts of probabilistic and linear methods | | | | | | | | | | | | | | | | | | | | | K4 |
| CO5 | Distinguish Supervised, Unsupervised, and semi supervised learning | | | | | | | | | | | | | | | | | | | | | K4, K5 |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create | | | | | | | | | | | | | | | | | | | | | | |
| **Unit:1** | | **Artificial Intelligence** | | | | | | | | | | | | | | **18 hours** | | | | | | |
| Artificial Intelligence: Introduction - Brief History and Evolution – AI Concepts and Terminology – Applications - Intelligent Agents and Environments – Problem Solving and Search Algorithms – Knowledge Representation and Reasoning – Expert Systems – AI Ethics and Societal Implications - Bias and Fairness - Privacy and Security Concerns - Future Trends - Emerging Technologies in AI and ML | | | | | | | | | | | | | | | | | | | | | | |
| **Unit:2** | | **Machine Learning: Linear Models** | | | | | | | | | | | | | | **18—hours** | | | | | | |
| Introduction: Machine Learning - Applications - Types of Machine Learning - Supervised Learning- Linear Models - Regression - Linear Basis Function Models - The Bias- Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison Linear Models for Classification - Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Pruning. Support Vector Machines - Ensemble methods- Bagging- Boosting – Evaluation Methods | | | | | | | | | | | | | | | | | | | | | | |
| **Unit:3** | | **Unsupervised Learning** | | | | | | | | | | | | | | **18—hours** | | | | | | |
| Unsupervised Learning Clustering- K-means Clustering - Hierarchical Clustering - The Curse of Dimensionality - Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA - EM - Mixtures of Gaussians - high-dimensional spaces - Independent components analysis - Anomaly Detection | | | | | | | | | | | | | | | | | | | | | | |
| **Unit:4** | | **Reinforcement Learning** | | | | | | | | | | | | | | **18 - hours** | | | | | | |
| Advanced Learning Sampling – Basic sampling methods – Monte Carlo. Reinforcement Learning- K-Armed Bandit Elements - Model-Based Learning- Value Iteration- Policy Iteration. Temporal Difference Learning Exploration Strategies- Deterministic and Non-deterministic Rewards and Actions- Eligibility Traces - Generalization- Partially Observable States- Computational Learning Theory - Mistake bound analysis - Sample Complexity Analysis | | | | | | | | | | | | | | | | | | | | | | |
| **Unit:5** | | **Deep Learning** | | | | | | | | | | | | | | | **18—hours** | | | | | |
| **Introduction to Deep Learning:** Fundamentals of Deep Learning- Learning process of Neural Network - Anatomy - Data representation – Model Parameterization – Hyperparameter - Basic Configuration - Feedforward Networks - Gradient based optimization - Backpropagation components - regularization, autoencoders - **Convolutional Networks:** The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, AlexNet - **Recurrent Neural Networks:** Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks - The Long Short-Term Memory and Other Gated RNNs | | | | | | | | | | | | | | | | | | | | | | |
| **Unit:6** | | **Case Studies and Practical Projects** | | | | | | | | | | | | | | | **2 hours** | | | | | |
| Real-world Case Studies Demonstrating the Applications of AI and ML– Hands-on Projects and Exercises for Implementation and Practice | | | | | | | | | | | | | | | | | | | | | | |
| **Total hours** | | | | | | | | | | | | | | | | | **92 hours** | | | | | |
| **Text Books** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006 | | | | | | | | | | | | | | | | | | | | | |
| 2 | Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012 | | | | | | | | | | | | | | | | | | | | | |
| 3 | Ethem Alpaydin, “Introduction to Machine Learning 3(Adaptive Computation and Machine Learning Series)”, Third Edition, MIT Press, 2014 | | | | | | | | | | | | | | | | | | | | | |
| 4 | Tom M Mitchell, “Machine Learning”, First Edition, McGraw Hill Education, 2013. | | | | | | | | | | | | | | | | | | | | | |
| 5 | Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth  edition, 2020. | | | | | | | | | | | | | | | | | | | | | |
| 6 | Richard S. Sutton and Andrew G. Barto, “Reinforcement Learning: An Introduction”, Second edition, 2015 | | | | | | | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Jannes Klaas, “Machine Learning for Finance”, ISBN: 978178936364, 2019 [Packt] | | | | | | | | | | | | | | | | | | | | | |
| 2 | Giuseppe Bonaccorso, “Machine Learning Algorithms”, Second Edition, ISBN: 9781789347999, 2018 [Packt] | | | | | | | | | | | | | | | | | | | | | |
| 3 | Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009 | | | | | | | | | | | | | | | | | | | | | |
| 4 | Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning”, Second Edition, Springer, 2008 | | | | | | | | | | | | | | | | | | | | | |
| 5 | Yuxi Liu, “Python Machine Learning By Example”, 2017 [Packt] | | | | | | | | | | | | | | | | | | | | | |
| 6 | John Paul Mueller, Luca Massaron, “Machine Learning (in Python and R) For Dummies”, First Edition, Wiley Publisher, ISBN: 9788126563050, 2016 | | | | | | | | | | | | | | | | | | | | | |
| 7 | U DineshKumar Manaranjan Pradhan,,“Machine Learning using Python”, Publisher: Wiley, ISBN: 9788126579907, 2019 | | | | | | | | | | | | | | | | | | | | | |
| **Online Course:** | | | | | | | | | | | | | | | | | | | | | | |
| **S. No** | **Course Title** | | | | | | | | | | **Duration** | | | | **Provider –Free** | | | | | | | |
| 1. | AI for Everyone | | | | | | | | | | 4 Weeks | | | | Coursera | | | | | | | |
| 2. | Introduction to Artificial Intelligence | | | | | | | | | | 16 Weeks | | | | Udacity | | | | | | | |
| 3. | Machine Learning: Regression | | | | | | | | | | 6 Weeks | | | | Coursera | | | | | | | |
| 4. | Introduction to Machine Learning | | | | | | | | | | 12 Weeks | | | | Swayam –NPTEL | | | | | | | |
| 5. | Deep Learning Specialization | | | | | | | | | | 4 Courses | | | | Coursera | | | | | | | |
| **Mapping with Programme Outcomes** | | | | | | | | | | | | | | | | | | | | | | |
| **COs** | | | **PO1** | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | | **PO7** | **PO8** | | | | | **PO9** | | **PO10** | | |
| **CO1** | | | M | |  |  | | S | S | M | | M | S | | | | | M | | M | | |
| **CO2** | | | S | |  | M | |  | S | S | | M |  | | | | | S | | S | | |
| **CO3** | | |  | | S | S | | M | S | S | |  | M | | | | |  | |  | | |
| **CO4** | | |  | | S | S | |  |  | M | |  | S | | | | |  | | M | | |
| **CO5** | | | S | | S |  | | M |  |  | | M | S | | | | | M | | S | | |

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| **Course code** | | | | **25CSEAC10** | **WEB TECHNOLOGIES** | | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | Core | | | **2** | | | **0** | | **2** | **4** |
| **Pre-requisite** | | | | | RDBMS | | | **Syllabus Version** | | | | **1.0** | | |
| **Course Objectives:** | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To create web pages using HTML and CSS 2. To develop interactive and dynamic web applications using JavaScript, 3. To understand server side development using Node.js and Express 4. To learn MySQL and MongoDB databases and access them using Node.js 5. To develop dynamic and responsive web applications using React | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | |
| 1 | | | Create web pages using HTML and CSS | | | | | | | | | | K3 | |
| 2 | | | Develop web pages using HTML, CSS and JavaScript | | | | | | | | | | K5 | |
| 3 | | | Learn server side development using Node.js and understand API development with Express | | | | | | | | | | K3 | |
| 4 | | | Understand MySQL and MongoDB databases and access them using Node.js | | | | | | | | | | K4 | |
| 5 | | | Learn web application development using React | | | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | |
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| **Unit:1** | | | | **Introduction to HTML, CSS** | | | | | | **10 hours** | | | | |
| HTML: Fundamentals – headings, linking, images, special characters, horizontal rules, lists, tables, forms, internal linking – CSS: Introduction – inline styles – embedded style sheets – conflicting styles – linking external style sheets – positioning elements – backgrounds – element dimensions – box model and text flow – media types | | | | | | | | | | | | | | |
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| **Unit:2** | | | | **Introduction to JavaScript** | | | | | **20 hours** | | | | | |
| JavaScript: What is JavaScript? – JavaScript in HTML – Language Basics – Variables – Basic Reference Types – Objects, Classes and Object Oriented Programming – Functions – Arrow Functions – Promises Async Functions – Browser Object Model – Document Object Model – Events – Client-Side Storage | | | | | | | | | | | | | | |
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| **Unit:3** | | | | **Server Side Programming with Node.js and Express** | | | **20 hours** | | | | | | | |
| Learning Node.js: Getting Started with Node.js – Using Events, Listeners, Timers, and Callbacks – Handling Data I/O – Accessing the File System – Implementing HTTP Services – Node.js and Express: Implementing Express in Node.js - Configuring routes - Using Request and Response objects | | | | | | | | | | | | | | |
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| **Unit:4** | | | | **Nodes.js and Databases** | | | **20 hours** | | | | | | | |
| MongoDB: Getting Started with MongoDB – MongoDB and Node.js – Manipulating MongoDB Documents from Node.js – Accessing MongoDB from Node.js – MySQL: Connecting to MySQL using node-mysql – Adding Data to the Database – Reading Data Efficiently | | | | | | | | | | | | | | |
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| **Unit:5** | | | | **Web Development using React** | | **20 hours** | | | | | | | | |
| React: Introduction – Virtual DOM – React Elements – ReactDOM – React Components –React Elements as JSX – Property Validation – React State Management – State Within the Component Tree - MERN Stack: MERN Components – Why MERN? – CRUD Operations using MongoDB, Express, Node JS and React | | | | | | | | | | | | | | |
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| **Unit:6** | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | |
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|  | | | | **Total hours** | | **92 hours** | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | |
| 1 | Harvey Deitel, Abbey Deitel, “Internet & World Wide Web –How to Program”, Fifth Edition, Pearson Education, 2012.(Unit:1) | | | | | | | | | | | | | |
| 2 | Matt Frisbie, “Professional JavaScript for Web Developers”, Wiley Publishing Inc, Fourth Edition, 2019. (Unit:2) | | | | | | | | | | | | | |
| 3 | Brad Dayley, Brendan Dayley, and Caleb Dayley, “Node.js, MongoDB, and Angular Web Development”, Pearson Education, Second Edition, 2018. (Units: 3, 4) | | | | | | | | | | | | | |
| 4 | Pedro Telxeira, “Professional Node.js: Building JavaScript Based Scalable Software”, John Wiley & Sons Inc., 2013. (Unit: 4) | | | | | | | | | | | | | |
| 5 | Alex Banks, Eve Porcello, "Learning React", O’Reilly Media, Inc, 2nd Edition, 2020. (Unit:5) | | | | | | | | | | | | | |
| 6 | Vasan Subramanian, ‘Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node’, Second Edition, Apress, 2019. (Unit: 5) | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | |
| 1 | DT Editorial Services, “HTML 5 Black Book”, Dream Tech Publishers, 2016. | | | | | | | | | | | | | |
| 2 | Kogent Learning Solutions Inc., “Web Technologies: Black Book”, Dream Tech Publishers, 2009 | | | | | | | | | | | | | |
| 3 | John Dean, “Web Programming”, Jones & Barlett Learning, 2019. | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | |
| 1 | | Introduction to Modern Application Development (https://archive.nptel.ac.in/courses/106/106/106106156/) | | | | | | | | | | | | |
| 2 | | Full Stack Web Development (https://www.coursera.org/learn/fullstack-web-development) | | | | | | | | | | | | |
| 3 | | https://www.tutorialspoint.com/the\_full\_stack\_web\_development/index.asp | | | | | | | | | | | | |
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| Course Designed By: **Dr. R. Rajeswari** | | | | | | | | | | | | | | |

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

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| **Course**  **code** | | | | **25CSEAC11** | | **Big Data Analytics** | | | **L** | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | **Core** | | | **4** | | | **2** | **2** | **4** |
| **Pre-requisite** | | | | | | **Nil** | | | **Syllabus Version** | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the concepts of Data Warehouse architecture and apply for various domains. 2. To understand Data Mining techniques Cluster, Classification and Association Rule Mining. 3. To understand the concepts of Web mining, Text mining and Spatial mining. | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | |
| 1 | | | Understand data mining tools and techniques for various domains | | | | | | | | | | K2 | |
| 2 | | | Apply various data mining, text mining and web mining algorithms for real time applications | | | | | | | | | | K3 | |
| 3 | | | Analyze unsupervised and supervised algorithms for real world applications | | | | | | | | | | K4 | |
| 4 | | | Illustrate the mining techniques like association, classification and clustering on datasets | | | | | | | | | | K6 | |
| 5 | | | Compare various approaches of data mining algorithms | | | | | | | | | | K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Data Warehousing** | | | | | | **18 hours** | | | |
| Data Warehouse - Introduction - Multidimensional data model - OLAP operations - Warehouse schema - Data warehousing architecture - Warehouse Schema - Warehouse server - Meta data - OLAP Engine - Data warehouse backend process - Data Warehouse Technology - Warehousing Software - Cloud data warehousing - Other features. Data Warehousing Case Study: Government, Tourism and Industry. | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Data Mining** | | | | | **18 hours** | | | | |
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| Data Mining: Introduction – Data as a Subject - Definitions- KDD vs. Data mining- DM techniques-Current Trends in Data Mining. Association Rules: Concepts- Methods to discover Association rules- A priori algorithm – Partition algorithm- Pioneer search algorithm – Dynamic Item set Counting algorithm- FP-tree growth algorithm-Incremental Algorithm | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Clustering & Classification techniques** | | | **18 hours** | | | | | | |
| Clustering: Data Attribute Types – Data Similarity and Dissimilarity - Clustering paradigms– Partition algorithm- K-Medoid algorithms – CLARA- CLARANS –Hierarchical DBSCAN-BIRCH- CURE-Categorical clustering algorithms.  Classification: Introduction – Decision Trees: Tree Construction Principle – Attribute Selection measure – Tree Pruning - Decision Tree construction Algorithm – CART – ID3 - Rainforest - Pruning Technique – Model Evaluation – Cross Validation – Bootstrap – Holdout – Classifier Performance- Boosting – AdaBoost– Bagging | | | | | | | | | | | | | | |
| **Unit:4** | | | | | **Data Insights: Exploratory Data Analytics** | | | **18 hours** | | | | | | |
| Introduction - Overview and History of R - Data Types - R Objects and Attributes - Data Dimensions - Vectors –Removing Missing Values-Combining Variables - Vectorized Operations – Apply() - Cleaning Data - Central Tendency - Data Distribution: Data standardizing - Sampling Distributions – ANNOVA Model – Parametric test - Non-Parametric Test - Visualization Packages – Understanding Plots - Univariate Visualization: Histogram – Box Plot- Bar Chart - Multivariate Visualizations: Scatter Plot- Heat Map - Reports& Dashboards. | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Unstructured Data** | | **18 hours** | | | | | | | |
| Text Mining - NLP: Text Pre-Processing-Sentence Segmentation - Tokenization - Lemmatization - Stemming - Parsing Text - Keywords- POS, Bag Of Words - N-Grams - Chunking - Named Entity Recognition (NER) Corpus - Vectors - Document Standardization And Representation – Inverted Index-Term Document Matrix (TDM): Large Language Models (Llms) - Text Embeddings - Similarity Between Text- Dot Product Similarity- Cosine Similarity- Prompting Techniques: Self-Consistency - Prompting As Parameter-Efficient Fine- Tuning - Prompting- Models - In-Context Learning - Semantic Search- Multilingual Semantic Search. | | | | | | | | | | | | | | |
| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | |
| Write an assignment on any one of the following:  1. Feature Engineering and Aspects of data ethics in a changing world.  2. Analyze Global Datasets to understand Issues on Climate Change, Epidemic and Pandemic Outburst | | | | | | | | | | | | | | |
|  | | | | | **Total hours** | | **92 hours** | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | |
| 1 | | Jiawei Han, MichelineKamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann Publishers, 2012 | | | | | | | | | | | | |
| 2 | | Pieter Adriaans, DolfZantinge, “Data Mining”, Addison Wesley, 2008. | | | | | | | | | | | | |
| 3 | | V. Bhuvaneswari, “Data Analytics with R – Step by Step”, SciTech Publications, 2016. | | | | | | | | | | | | |
| 4 | | Roger D. Peng, “R Programming for Data Science” Lean Publishing, 2014 | | | | | | | | | | | | |
| 5 | | Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters,“A Beginner’s Guide to R” Springer, 2009 | | | | | | | | | | | | |
| 6 | | [Hadley Wickham](https://www.amazon.com/Hadley-Wickham/e/B002BOA9GI/ref=dp_byline_cont_book_1), “R for Data Science: Import, Tidy, Transform, Visualize, and Model Data”, First Edition, O'Reilly Media Publisher, ISBN: 9781491910399, 2017 | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | |
| 1 | | Arun K Pujari, “Data Mining Techniques”, Universities Press. 2012 | | | | | | | | | | | | |
| 2 | | Brett Lantz, “Machine Learning with R”, Third Edition, ISBN: 9781788295864, 2019, [Packt] | | | | | | | | | | | | |
| 3 | | Kaelen Medeiros, “R Programming Fundamentals”, ISBN: 9781789612998, 2018, [Packt] | | | | | | | | | | | | |
| 4 | | VitorBinanchiLanzetta, “Hands-On Data Science with R”, ISBN: 9781789139402, 2018, [Packt] | | | | | | | | | | | | |
| 5 | | [Jared P. Lander](https://www.amazon.in/Jared-P-Lander/e/B00E9B3JO0/ref=dp_byline_cont_book_1), “R for Everyone: Advanced Analytics and Graphics”, Second Edition, Pearson Education Publisher, ISBN: 9789386873521, 2018 | | | | | | | | | | | | |
| 6 | | [Nina Zumel](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Nina+Zumel&search-alias=stripbooks), “Practical Data Science with R”, Dreamtech Press Publisher, ISBN: 9789351194378, 2014 | | | | | | | | | | | | |
| 7 | | [Hadley Wickham](https://www.amazon.com/Hadley-Wickham/e/B002BOA9GI/ref=dp_byline_cont_book_1), “Advanced R”, Second Edition, CRC Publisher, ISBN: 978-0815384571, 2019 | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | |
|  | |  |  |  | | --- | --- | --- | |  | R Programming | 4 Weeks | |  | Data Analysis with R | 8 Weeks | |  | Introduction to Data Analytics | 9 Weeks | | | | | | | | | | | | | | |
| **Web Link**   1. <http://www.celta.paris-sorbonne.fr/anasem/papers/miscelanea/InteractiveDataMining.pdf> 2. <https://www.peterindia.net/DataMiningLinks.html> 3. https://www.datacamp.com/tracks/r-programming 4. <https://www.datamentor.io/r-programming/> 5. https://web.stanford.edu/~jurafsky/slp3 | | | | | | | | | | | | | | |
| Course Designed By: Dr. V. Bhuvaneswari | | | | | | | | | | | | | | |

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

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

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| **Course code** | | | | | | **25CSEAC12** | | | | **INTERNET OF THINGS** | | | | | | | | | **L** | | | **T** | | | **P** | | | **C** |
| **Core/Elective/Supportive** | | | | | | | | | | Core | | | | | | | | | **2** | | | **0** | | | **2** | | | **4** |
| **Pre-requisite** | | | | | | | | | | Basic knowledge of hardware,  Programming in C | | | | | | | | | **Syllabus Version** | | | | | | | **1.0** | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To gain insight about the architecture and enabling technologies of Internet of Things 2. 2. To understand Arduino micro controller and Raspberry Pi   3. To develop simple IoT Applications for different domains | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CO1 | | | | | To learn the importance of smart objects and smart environment | | | | | | | | | | | | | | | | | | | K1 | | | | |
| CO2 | | | | | To understand and use the microcontroller and various sensors | | | | | | | | | | | | | | | | | | | K2 | | | | |
| CO3 | | | | | To create programs using Arduino IDE and extract data | | | | | | | | | | | | | | | | | | | K3 | | | | |
| CO4 | | | | | To perform WiFi data communications, remote data storage in cloud, and handle the data using web applications | | | | | | | | | | | | | | | | | | | K3, K4 | | | | |
| CO5 | | | | | To identify potential problems and develop solutions using IOT | | | | | | | | | | | | | | | | | | | K5, K6 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | | | **Introduction to IOT** | | | | | | | | | | | | | | **10 hours** | | | | | | | |
| Introduction to IOT - Enabling technologies of IOT - AI and Machine Learning - Physical and logical design of IoT - IOT Architecture - IoT levels and deployment templates – Application domains of IoT: Home automation – Environment –Industry – Agriculture – Transportation - Health care. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | | | **Basic Electronics for IoT & Arduino IDE** | | | | | | | | | | | | | **20 hours** | | | | | | | | |
| Basic electronic components and power elements: Electric Charge, Resistance, Current and Voltage – Resistors, Capacitors, Diodes, LED, Potentiometer, circuit boards - Analog and digital circuits – Microcontrollers – Electronic Signals – A/D and D/A Conversion – Pulse Width Modulation  Arduino IDE: Installation and Set-up - Programming Fundamentals with C using Arduino IDE Program Structure in C - Basic Syntax - Data Types / Variables / Constants - Operators, Conditional Statements and Loops - Using Arduino C Library functions. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | | | **Arduino Microcontroller and sensors** | | | | | | | | | | | **20 hours** | | | | | | | | | | |
| Working with Arduino: LED and Switch - Data acquisition with IOT Devices - Understanding the Inputs from Sensors - Temperature Sensors – Ultrasonic Sensor - Humidity sensor - IR Sensor – PIR Sensor - Accelerometer and vibration sensor. Understanding the Outputs through Actuators - Activating LED Lights - Activating Relays - Activating Buzzer - Running DC Motors - Running Stepper Motors and Servo Motors. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | | | **Medical Sensors &**  **Data Communication from IOT devices** | | | | | | | | | | | **20 hours** | | | | | | | | | | |
| Introduction to Medical Sensors: Body Temperature Sensor - Blood Pressure Sensor -Airflow sensor - Patient position sensor - Pulse and oxygen in blood sensor (SPO2) - Galvanic skin response sensor.  Using Communication Devices to transfer data from IOT Devices - WIFI data transfer - Remote Communication to cloud/external applications. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | | | **Raspberry Pi** | | | | | | | | | | **20 hours** | | | | | | | | | | | |
| Introduction to Raspberry Pi - Models - Peripherals - Applications of Raspberry Pi. Setting up Raspberry Pi – NOOBS – GPIO Pin configuration.  Programs using Raspberry Pi: LED interfacing – Buzzer interfacing – Digital sensors interfacing. | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | | | **Contemporary Issues** | | | | | | | | | | **2 hours** | | | | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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|  | | | | | | | **Total Lecture hours** | | | | | | | | | | **92 hours** | | | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Arshdeep Bahga, Vijay Madisetti, ‘Internet of Things: A Hands-On Approach’, Universities Press, 2015. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | Boris Adryan, Dominik Obermaier, Paul Fremantle, ‘The Technical Foundations of IoT’, Artech Houser Publishers, 2017. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | Michael Margolis, “Arduino Cookbook” 2nd Edition, O'Reilly Media, 2012. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | Marco Schwartz, ‘Internet of Things with ESP8266’, Packt Publishing, 2016. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | Tim Cox, Steven Laurence Fernandes, Raspberry Pi3 Cookbook for Python Programmers, Third Edition, Packt Publishing, 2018. | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Charles Platt, “Make Electronics – Learning by discovery”, O'Reilly Media, 2015. | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | Michael Miller, “ The Internet of Things”, Pearson India, 2015. | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | Introduction to IOT, <https://nptel.ac.in/courses/106/105/106105166/> | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Course Designed By: **Dr. T. Amudha** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Mapping with Programme Outcomes** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **COs** | | | **PO1** | | | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | | | | | | | **PO10** | | | |
| **CO1** | | | S | | | | S |  | |  |  |  |  |  |  | | | | | | |  | | | |
| **CO2** | | |  | | | | L | S | | S |  |  |  |  |  | | | | | | |  | | | |
| **CO3** | | |  | | | | M | L | | L |  |  |  |  | M | | | | | | | M | | | |
| **CO4** | | |  | | | | L | S | | S |  |  |  |  | M | | | | | | | M | | | |
| **CO5** | | |  | | | | L | M | | M |  |  |  |  | L | | | | | | | L | | | |
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\*S-Strong; M-Medium; L-Low

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| **Course code** | | **25CSEAC13** | **CRYPTOGRAPHY & INFORMATION SECURITY** | | **L** | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | **Core** | | **4** | | **0** | **0** | **4** |
| **Pre-requisite** | | | Basic knowledge of Information Security | | **Syllabu s Version** | | | **1** | |
| **Course Objectives:** | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the basics of cryptography and network security model 2. To understand the types of cryptographic algorithms 3. To discuss about the system security attacks and network security assessment 4. To know about assessment of operating system and database security 5. To understand the ethical and legal issues in computer security | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | |
| On successful completion of the course, students will be able to: | | | | | | | | | |
| 1 | Learn basics of cryptography and network security | | | | | K1,K2 | | | |
| 2 | Understand the types of cryptographic algorithms | | | | | K2,K4 | | | |
| 3 | Know how to prevent security attacks | | | | | K2,K4 | | | |
| 4 | Illustrate the security attacks | | | | | K4,K5 | | | |
| 5 | Understand ethical and legal issues and applyCryptography algorithms | | | | | K2, K3,  K5 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | |
|  | | | | | | | | | |
| **Unit:1** | | **Introduction to Cryptography** | | | **10 hours** | | | | |
| Introduction to security attacks - services and mechanism - introduction to cryptography - Classical Encryption Techniques – Network Security Model – Data Encryption Standard-Triple DES-block cipher modes of operations –steganography-key range and key size –Possible types of attacks-- Electronic Mail Security-IP Security- Web Security-Knapsack algorithm | | | | | | | | | |
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| **Unit:2** | | **Public Key Cryptography** | | | **12 hours** | | | | |
| Number Theory concepts – Primality for testing – Modular Arithmetic – Fermat & Euler Theorem – Euclid Algorithm – RSA Algorithm – Elliptic Curve Cryptography – Diffie Hellman Key Exchange - Cryptographic hash functions - Cipher Block Chaining - Secure Hash Algorithm - Digital Signature: Schnorr Digital Signature Scheme -Digital Signature Standard – Kerberos | | | | | | | | | |
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| **Unit:3** | | **System Security** | | **12 hours** | | | | | |
| Intruders-Intruder detection-Password management- Viruses- virus countermeasures-worms-DOS attack- Types of Firewalls – Firewall Designs – IDS and types, Honey Pots-Packet Sniffing-SET for E Commerce Transactions –Chinese Remainder Theorem-birthday attacks | | | | | | | | | |
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| **Unit:4** | | **Operating System and Database Security** | **14 hours** |
| Internet Key Exchange (Phases of IKE), PGP - Access Control – File Protection mechanism- User authentication-Wireless application protocol (WAP) –software vulnerabilities-Bufferoverflow, Format String,Cross-site Scripting,SQL Injection,Rootkits- Protocol overview – Single SignON- Security Requirements-SSH- Multilevel database. | | | |
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| **Unit:5** | | **Ethical and Legal Issues in Computer Security** | **12 hours** |
| Cybercrime- Computer crime-Trusted Systems- Secure Inter-branch Payment Transactions-Combining Security associations-Information and law-Ethical issues-case studies. | | | |
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| **Unit:6** | | **Contemporary Issues** | **2 hours** |
| Submit an assignment by on cryptographic algorithms in network security | | | |
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|  | | **Total hours** | **62 hours** |
| **Text Book(s)** | | | |
| 1 | Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition. | | |
| 2 | Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition | | |
| 3 | Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition. | | |
| 4 | Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition. | | |
| 5 | Information Security, Principles, and Practice: Mark Stamp, Wiley India. | | |
| 6 | Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH | | |
| 7 | Introduction to Network Security: Neal Krawetz, CENGAGE Learning | | |
| 8 | Network Security and Cryptography: Bernard Menezes, CENGAGE Learning | | |
|  | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
| 1 | https://www.coursera.org/specializations/applied-crypto | | |
| 2 | <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks> | | |
| 3 | https://www.udemy.com/course/isoiec-27001-information-security-management-system/ | | |
|  | https://nptel.ac.in/courses/106105162 | | |
| **Web Link**   1. https://www.tutorialspoint.com/what-is-cryptography-in-information-security 2. https://www.geeksforgeeks.org/cryptography-and-network-security-principles/ | | | |
| Course Designed By: Dr. S. Gavaskar | | | |



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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 | L | S | S | M | M |
|  | **CO2** | S | S | S | M | M | L | M | M | M | M |
|  | **CO3** | S | S | L | M | M | S | M | S | M | S |
|  | **CO4** | M | L | L | S | S | S | M | M | S | M |
|  | **CO5** | S | S | S | S | M | S | M | S | M | S |

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

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|  | | **Course Code** | | | | | **25CSEAC15** | | | **Research Methods in Computer Applications** | | | | | | | **L** | | | | | | **T** | | **P** | **C** |
|  | | **Core/Elective/Supportive** | | | | | | | | **Core – Self Study** | | | | | | |  | | | | | |  | |  | **2** |
|  | | **Pre-requisite** | | | | | | | | Basic Understanding of Research | | | | | | | **Syllabus**  **Version** | | | | | | | | **2025 – 2026** | |
|  | | **Course Objectives:** | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | The main objectives of this course are to:   1. To understand the fundamentals and Types of Research. 2. To understand about formulating hypotheses and research demands. 3. To understand the Research Design and Data Collection. 4. To understand the Report Writing. 5. To understand Results and Ethics. | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | 1 | | Understand the fundamentals and Types of Research | | | | | | | | | | | | | | | | | | | | K2 | | |
|  | | 2 | | Understand the formulating hypotheses | | | | | | | | | | | | | | | | | | | | K2 | | |
|  | | 3 | | Understand the Research Design and Data Collection | | | | | | | | | | | | | | | | | | | | K2 | | |
|  | | 4 | | Understand the Report Writing and Ethics | | | | | | | | | | | | | | | | | | | | K2 | | |
|  | | 5 | | Analyze, Apply, Create and Evaluate | | | | | | | | | | | | | | | | | | | | K3 – K6 | | |
|  | | **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | | | | | | | | | | |
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|  | | **Unit:1** | | | | | **Objectives and Types of Research** | | | | | | | | | | | | |  | | | | | | |
|  | | Motivation and objectives – Research methods vsMethodology - Types of research – Descriptive vs Analytical, Applied vs Fundamental, Quantitative vs Qualitative, Conceptualvs .Empirical. | | | | | | | | | | | | | | | | | | | | | | | | |
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|  | | **Unit:2** | | | | | **Research Formulation & Literature Review** | | | | | | | | | | | | |  | | | | | | |
|  | | Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs - patents – web as a source – searching the web - Critical literature review–Identifying gap areas from literature review – Development of working hypothesis | | | | | | | | | | | | | | | | | | | | | | | | |
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|  | | **Unit:3** | | | | | **Research Design, Data collection and Analysis** | | | | | | | | | | | |  | | | | | | | |
|  | | Research design – Features of good design – Important concepts relating to research design – Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis, Experimentation. Determining experimental and sample designs. Data Collection Methods of data collection – Sampling Methods- Data Processing and Analysis strategies | | | | | | | | | | | | | | | | | | | | | | | | |
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|  | | **Unit:4** | | | | | **Reporting and Thesis Writing** | | | | | | | | | | | |  | | | | | | | |
|  | | Structure and components of scientific reports - Types of report – Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables Bibliography, referencing and footnotes - Oral presentation – Planning – Preparation – Practice –Making presentation – Use of visual aids – Importance of effective communication. | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | **Unit:5** | | | | | **Application of Results and Ethics** | | | | | | | | | | |  | | | | | | | | |
|  | | Environmental impacts - Ethical issues - ethical committees - Commercialization – Copy right – royalty - Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability. | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Text Book(s)** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002.An introduction to Research Methodology, RBSA Publishers. | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | Kothari,C.R.,1990.ResearchMethodology:MethodsandTechniques.NewAgeInternational.418p. | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes. | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p. | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographic alindications. Universal Law Publishing. | | | | | | | | | | | | | | | | | | | | | | | |
| **Reference Books :** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. *Research Methods: AProcessof Inquiry*, Allyn and Bacon. | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | Carlos, C.M., 2000. *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options* .ZedBooks, NewYork. | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | Coley, S.M. and Scheinberg, C. A., 1990, *"Proposal Writing",* Sage Publications. | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | Day,R.A.*,*1992.*How to Write and Publisha Scientific Paper,* Cambridge University Press. | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | Fink, A., 2009. *Conducting Research Literature Reviews: From the Internet to Paper .*Sage Publications | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | Leedy,P.D.andOrmrod,J.E.,2004*PracticalResearch:PlanningandDesign,*Prentice Hall. Satarkar, S.V., 2000. *Intellectual property rights and Copy right*. Ess Ess Publications | | | | | | | | | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Web link** | | | | | | | | | | | | |  | | | | | | | |  | | | | |
| 1. <https://www.geeksforgeeks.org/introduction-to-research-methodology/> 2. <https://sagepub.libguides.com/c.php?g=453083&p=3094888> | | | | | | | | | | | | | | | | | | | | | | | | | |
| Course Designed by: **Dr.M. Punithavalli** | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mapping with Programme Outcomes | | | | | | | | | | | | | | | | | | | | | | | | | |
| **COs** | | | | **PO 1** | **PO2** | | **PO3** | **PO4** | | **PO5** | **PO6** | **PO7** | | **PO8** | **PO9** | | | | | **PO10** | | | | | |
| **CO1** | | | | L | M | | M | M | | L | L | L | | M | M | | | | | M | | | | | |
| **CO2** | | | | L | S | | S | M | | M | L | M | | L | S | | | | | S | | | | | |
| **CO3** | | | | L | M | | M | S | | L | L | M | | L | L | | | | | M | | | | | |
| **CO4** | | | | L | S | | S | S | | M | L | M | | L | S | | | | | S | | | | | |
| **CO5** | | | | L | M | | S | S | | M | L | L | | M | M | | | | | S | | | | | |

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| **Course code** | | **25CSEAC16** | **DevOps & Agile Methodology** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Core – Self Study** |  |  | |  | **2** |
| **Pre-requisite** | | | **Nil** | **Syllabus Version** | | | **1.0** | |
| **Course Objectives:** | | | | | | | | |
| The main objectives of this course are to:   1. To understand the new ways of thinking, working, organizing, and measuring to fully gain the benefits of DevOps. 2. To understand the actionable measures that apply directly to decision-making and will ultimately result in continuous improvement. | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | |
| **On the successful completion of the course, student will be able to:** | | | | | | | | |
| 1 | Learn how business models are disrupted by innovation and that technology is the enabler of innovation, rather than the driver of innovation. That influential people helped others see that DevOps is a better way to work. | | | | | K1, K2 | | |
| 2 | To examine how creating shared repositories and pair programming results in defects found earlier and a broader understanding of the code base for the team. | | | | | K3 | | |
| 3 | You will learn about new processes such Continuous Integration and Continuous Delivery that enable frequent deployments and working as a team to create high-quality code. | | | | | K2, K5 | | |
| 4 | You will learn Containerization & Orchestration platform, to manage and automate containerized applications. | | | | | K2, K3 | | |
| 5 | Learn the importance of monitoring what matters, such as social metrics and continuous improvement goals. | | | | | K4, K5, K6 | | |
| K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create | | | | | | | | |
| **Unit:1** | | **Introduction to Development Operations** | |  | | | | |
| Introduction - Brief History of DevOps - Introduction to DevOps - -Understanding the fundamentals of DevOps - Why DevOps is important -The benefits of DevOps- Business Case for DevOps - DevOps Adoption - Essential Characteristics of DevOps - Leading Up to DevOps - XP, Agile, and Beyond – Eclipse Setup | | | | | | | | |
| **Unit:2** | | **Networking Concepts and Code Management** | |  | | | | |
| Basic Linux and Networking Concepts: Architecture and Filesystem of Linux - Linux Commands - Services in Linux - Shell scripting - Package Management using YUM, APT - MONILITHIC & MICROSERVICES architecture.  Source Code Management using GitHub – Git Repository Guidelines - Version Control – Centralized and Distributed version Control system – GitHub GUI commands- GIT commands - Cloning – Merging -Staging – Branching – repository creation using API | | | | | | | | |
| **Unit:3** | | **Continuous Integration with Jenkins & MAven** | |  | | | | |
| Continuous Integration- Continuous Delivery - Jenkins – Installation Configuration – Management- Integration of JENKINS with GIT - Integration of Maven with Jenkins - Jenkins Dashboard - Remote Builds - User Management in Jenkins- Understating Plugins - dependency installation - Pipeline Creation using Jenkins for CI - Jenkins Testing - CI using Ansible | | | | | | | | |
| **Unit:4** | | **Containerization & Orchestration** | |  | | | | |
| Docker-Containers - Introduction to micro services - Introduction to Docker - Working with containers - docker HUB - Docker Demo - Docker Compose -Port forwarding, Yaml, Docker file- Orchestration using Kubernetes – Introduction to Kubernetes - Technical Overview of POD, NODE, Containers - Kubernetes Cluster - multimode architecture - SCALE IN/SCALE OUT of containers – Services – deployment architecture - HELM architecture overview | | | | | | | | |
| **Unit:5** | | **Continuous Monitoring** | |  | | | | |
| Monitoring using Prometheus and Grafana- Provisioning using Terraform – Introduction to Terraform - Cloud Formation - Build infrastructure - Terraform code- Change – destroy-manage infrastructure- Integrating Terraform on AWS - Updates to existing setup using Terraform – Use cases: real time industry-based Applications. | | | | | | | | |
| **Unit:6** | | **Contemporary Issues** | |  | | | | |
| 1. Social Coding Principles – Organization Behaviour - Architectures  2. Integration – Delivery – Organizational Impact \*/ /- Customer Response – DevOps tools. | | | | | | | | |
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| **Text Book(s)** | |
| 1 | Gene Kim, Jez Humble, Patrick Debois, John Allspaw and John Willis, “The DevOps Handbook”, IT Revolution Press; Illustrated edition, 2016, ISBN- 1942788002 |
| 2 | Gene Kim, Kevin Behr, George Spafford, “The Phoenix Project”, IT Revolution Press, 5th Anniversary edition, 2018, ISBN: 1942788290. |
| 3 | [Nicole Forsgren Phd](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Nicole+Forsgren+Phd&search-alias=stripbooks) (Author), [Jez Humble](https://www.amazon.in/Jez-Humble/e/B003SNGS8E/ref=dp_byline_cont_book_2) (Author), [Gene Kim](https://www.amazon.in/Gene-Kim/e/B00AERCJ9E/ref=dp_byline_cont_book_3) (Author), “Accelerate”, Tradeselect; Illustrated edition (27 March 2018), ISBN: 1942788339 |
| 3 | [Gene Kim](https://www.amazon.in/Gene-Kim/e/B00AERCJ9E/ref=dp_byline_cont_ebooks_1), “The Unicorn Project” IT Revolution Press, 2019 |
| **Reference Books : EBooks** | |
| 1 | Sanjeev Sharma and Bernie Coyne, “DevOps For Dummies”, 2nd IBM Limited Edition, Published by John Wiley & Sons, Inc. |
| 2 | Sanjeev Sharma and Bernie Coyne, “DevOps”, 3rd IBM Limited Edition, Published by John Wiley & Sons, Inc., ISBN: 978-1-119-41589-3 |

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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
|  | Course Title | Duration | Provider |
| 1. | DevOps, DataOps, MLOps | 26 hours | Coursera |
| 2. | Learning DevOps Tools Complete Course Step-by-Step (2023) | 18 hours | Udemy |
| 3. | Learning Path: Modern DevOps | 15 hours | Udemy |
| 4. | Learn DevOps: The Complete Kubernetes Course | 14 hours | Udmey |
| 5. | Continuous Delivery & DevOps (Free) | 9 hours | Coursera |
| **Web link** | |  |  |
| 1. https://about.gitlab.com/topics/devops/ 2. https://www.ibm.com/topics/devops 3. https://www.redhat.com/en/topics/devops 4. https://drive.google.com/drive/folders/11H4Kq9CTvQpTFKaj4GzPmO66eP8wGPDN?usp=share\_link | | | |
| Course Designed by: Prof. Dr. V. Bhuvaneswari | | | |

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

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

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| **Course code** | | **25CSEAE01** | **IT Infrastructure and Cloud Security** | **L** | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | **Elective** | **2** | | **0** | **2** | **4** |
| **Pre-requisite** | | | **Cloud, Networking Basics** | **Syllabus Version** | | | **1.0** | |
| **Course Objectives:** | | | | | | | | |
| The main objectives of this course are to:   1. To understand the concepts of Internet of Things 2. To learn how to use Cloud Services. 3. To implement Virtualization 4. To understand complex technologies leading to the development of current and future cloud computing security | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | |
| 1 | Understand the nature of malware, its capabilities, and how it is combated through detection and classification. | | | | | | K2 | |
| 2 | Understand the social, economic, and historical context in which malware occurs. | | | | | | K2 | |
| 3 | Analyze malicious in windows programs. | | | | | | K4 | |
| 4 | Apply the tools and methodologies used to perform static and dynamic analysis on unknown executable. | | | | | | K3 | |
| 5 | Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti- analysis techniques in future malware samples. | | | | | | K3 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | |
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| **Unit:1** | | **Introduction to Networking & Communication Protocols** | | | **10hours** | | | |
| **Networking:** Introduction to Corporate Infrastructure – LAN, MAN and WAN. **Internet of Things:** Introduction – Definition Evolution – IoT Architecture – Resource Management – IoT Data Management and Analytics – Communication Protocols – Identity Management and Authentication – Privacy. Device Collaboration Framework. | | | | | | | | |
| **Fog Computing** | | | | | | | | |
| **Unit:2** | |  | | | **14hours** | | | |
| **Fog Computing:** Introduction – Characteristics – Reference Architecture – Applications – Research Directions and Enables – Commercial Products. **Stream Processing in IoT:** Foundation of Stream Processing in IoT – Continuous Logic Processing System – Challenges and Future Direction. | | | | | | | | |
| **Cloud Computing Influences** | | | | | | | | |
| **Unit:3** | |  | | **12hours** | | | | |
| **Cloud Computing**: Introduction – Characteristics – Architectural Influences – Technological Influences – Operational Influences. **Cloud Computing Architecture**: Delivery Model – Deployment Model – Benefits. Cloud Security Services. | | | | | | | | |
| **Unit:4** | | **Virtualization & Data Center** | | **12hours** | | | | |
| **Cloud, Virtualization, and Data Storage & Data Center Networking Fundamentals:**  Server and Storage I/O Fundamentals – I/O Connectivity and Networking Fundamentals – IT Clouds – Virtualization: Servers, Storage and Networking – Virtualization and Storage Services | | | | | | | | |

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| – Data and Storage Access. **Infrastructure Resource Management:** Introduction - Managing  Data Infrastructure for Cloud Virtual Environments – Understanding IT Resources – Managing IT Resources | | | | | | |
| **Unit:5** | | | **Security Threats and Risks** | **12hours** | | |
| **Data and Storage Networking Security:** Security Threat Risks and Challenges – Securing  Networks – Securing Storage – Securing Clouds. **Data Protection:** Data Protection Challenges and Opportunities – Protect, Preserve, and Serve Information Services – Virtual – Physical, and Cloud Data Protection – Modernizing and Protection and Backup. | | | | | | |
| **Unit:6** | | | **Contemporary Issues** | **2 hours** | | |
| Internet of Robotic Things - Cloud-enabled Robotics. | | | | | | |
|  | | | **Total Lecture hours** | **62hours** | | |
| **Text Book(s)** | | | | | | |
| 1 | Rajkumar Buyya, Amir Vahid Dastjerdi, ―Internet of Things: Principles and Paradigms‖,  Morgan Kaufmann Publications, 2016. | | | | | |
| 2 | Ronald L. Krutz, Russell Dean Vines, ―Cloud Security: A Comprehensive Guide to Secure  Cloud Computing‖, Wiley Publishing, Inc. 2010. | | | | | |
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| **Reference Books** | | | | | | |
| 1 | Fei Hu, ―Security and Privacy in Internet of Things: Models, Algorithm and Implementations‖, CRC Press, 2016. | | | | | |
| 2 | John R. Vacca, ―Cyber Security and IT Infrastructure Protection‖, Syngress, 2013. | | | | | |
| 3 | Chris Dotson, ―Practical Cloud Security: A Guide for Secure Design and Deployment‖,  O‟Reilly Media Publications, 2019. | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | |
|  | https://onlinecourses.nptel.ac.in [Two Courses] | | | | | |
| 1 | Components And Applications Of Internet Of Things | | | 15 Weeks |  |
| 2 | Introduction to Industry 4.0 and Industrial Internet of Things. | | | 12 Weeks |  |
| **Web Link**  https:/[/www.classc](http://www.classcentral.com/course/cloud-computing-security-11754)e[ntral.com/course/cloud-computing-security-11754](http://www.classcentral.com/course/cloud-computing-security-11754)[Cloud Computing  Security] | | | | | | |
| Course Designed By: Dr. S. Gavaskar | | | | | | |



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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **COs** | **P O1** | **P O2** | **P O3** | **P O4** | **P O5** | **P O6** | **P O7** | **P O8** | **P O9** | **PO 10** |
| **CO1** | M | L | L | L | L | L | L | S | L | M |
| **CO2** | L | L | L | L | L | L | L | S | L | M |
| **CO3** | S | S | S | M | S | M | M | S | S | S |
| **CO4** | S | S | M | S | M | S | S | S | M | M |
| **CO5** | M | M | M | S | M | S | S | S | M | M |

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

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| **Course code** | | | **25CSEAE02** | | **MOBILE NETWORKING** | | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **Elective** | | | | **4** | | | **-** | | **0** | **4** |
| **Pre-requisite** | | | | **Nil** | | | | **Syllabus Version** | | | | **1.0** | | |
| **Course Objectives:** | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the basic concepts of Cellular System. 2. To understand the concepts of Radio Technology. 3. To understand GSM and GPRS concepts. 4. To understand 3G and UTMS concepts. | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | |
| CO1 | | Understand basic concepts of mobile network engineering used inthe design and rollout of mobile networks. | | | | | | | | | | | K2 | |
| CO2 | | Understand the principles, design constraints and provide a more advanced insight into the radio interface protocol stack, operation and dimensioning for three major mobile network technologies; the GSM, 3GWCDMA, 4G-LTE. | | | | | | | | | | | K2 | |
| CO3 | | Understand development towards the next generation of mobile networks (5G) | | | | | | | | | | | K3 | |
| CO4 | | Analyze the Mobile radio propagation, fading, diversity concepts and the channel modeling. | | | | | | | | | | | K4 | |
| CO5 | | Analyze Multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts. | | | | | | | | | | | K4 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | |
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| **Unit:1** | | | **Introduction, Cellular System, Radio Propagation** | | | | | | | **12 hours** | | | | |
| Introduction – Type of Mobile Network by Multiple-Access Scheme. Cellular System : Cellular Concept - Carrier-to-Interference Ratio - Formation of Clusters - Sectorization - Frequency Allocation - Trunking Effect - Erlang Formulas - Erlang B Formula. Radio Propagation: Propagation Mechanisms. | | | | | | | | | | | | | | |
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| **Unit:2** | | | **Mobile Radio Channel, Radio Network Planning** | | | | | | **12 hours** | | | | | |
| Mobile Radio Channel: Channel Characterization - Fading - Diversity to Mitigate Multipath Fading. Generic Link Budget: Receiver Sensitivity Level - Design Level - Rayleigh Fading Margin - Lognormal Fading Margin - Body Loss - Car Penetration Loss - Design Level - Building Penetration Loss - Outdoor-to-Indoor Design Level - Power Link Budget - Power Balance. | | | | | | | | | | | | | | |
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| **Unit:3** | | | **Global System Mobile, GSM, 2G** | | | | **12 hours** | | | | | | | |
| General Concept for GSM System Development - GSM System Architecture - Radio Specifications - Background for the Choice of Radio Parameters - Communication Channels in GSM - Mapping the Logical Channels onto Physical Channels - Signaling During a Call - Signal Processing Chain - Estimating Required Signaling Capacity in the Cell . | | | | | | | | | | | | | | |
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| **Unit:4** | | | **EGPRS: GPRS/EDGE** | | | | **12 hours** | | | | | | | |
| GPRS Support Nodes - GPRS Interfaces - GPRS Procedures in Packet Call Setups - GPRS Mobility Management - Layered Overview of the Radio Interface - Channel Sharing . | | | | | | | | | | | | | | |
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| **Unit:5** | | | **Third Generation Network (3G), UMTS** | | | **12 hours** | | | | | | | | |
| The WCDMA Concept - Major Parameters of 3G WCDMA Air Interface - Spectrum Allocation for 3G WCDMA - 3G Services - UMTS Reference Network Architecture and Interfaces - Air-Interface Architecture and Processing - Channels on the Air Interface - Physical-Layer Procedures - RRC States - RRM Functions - Initial Access to the Network . | | | | | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | | **2 hours** | | | | | | | | |
| High-Speed Packet Data Access - 4G-Long Term Evolution (LTE) System - Further Development for the Fifth Generation .  Expert lectures, online seminars – webinars | | | | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | | **62 hours** | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | |
| 1 | Alexander Kukushkin , “A Introduction to Mobile Network Engineering ”, John Wiley & Sons Ltd , 2018. | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | |
| 1 | Harish OM Sharma, “Mobile Network Technology”, 1st Edition, Evincepub Publishing, 2019. | | | | | | | | | | | | | |
| 2 | Yi-Bing Lin, “Wireless and Mobile Network Architecture” 3rd Edition, Wiley India Pvt.Ltd, 2008. | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | |
| 1 | Introduction to Wireless and Cellular Communications :  <https://swayam.gov.in/nd1_noc19_ee48/preview> | | | | | | | | | | | | | |
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| Course Designed By:**Dr. S. Gavaskar** | | | | | | | | | | | | | | |

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

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| **Course code** | | | | **25CSEAE03** | | **VIRTUALIZATION AND CLOUD** | | | **L** | | | **T** | | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | Elective | | | **3** | | | **0** | | **1** | | **4** |
| **Pre-requisite** | | | | | | Basic knowledge of data storage,  Client – Server systems | | | **Syllabus Version** | | | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To impart knowledge on the concepts of distributed systems, cloud computing and AWS 2. To gain knowledge over various virtualization and virtual machines 3. To gain understanding about the data centers | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | |
| CO1 | | | To learn the fundamentals of distributed systems | | | | | | | | | | K2 | | | |
| CO2 | | | To understand and use the cloud services and AWS | | | | | | | | | | K3 | | | |
| CO3 | | | To understand and perform virtualization | | | | | | | | | | K3, K6 | | | |
| CO4 | | | To create, configure and manage virtual machines | | | | | | | | | | K4 | | | |
| CO5 | | | To learn about data center | | | | | | | | | | K5 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Distributed Systems** | | | | | | **15 hours** | | | | | |
| Introduction to distributed systems - Distributed algorithm - Distributed Data Stores - Distributed Computing - File Systems - Distributed Messaging - Distributed Applications – Distributed Transaction - Parallel and distributed computing - Applications. | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Cloud Computing** | | | | | **15 hours** | | | | | | |
| Cloud Concepts: Introduction Cloud Computing - Advantages of Cloud - Public Cloud - five essential characteristics - three service models - Four deployment models - Benefits of Cloud Computing - Cloud Vendors - Traditional Infrastructure setup and Challenges – AWS. | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Virtualization** | | | **15 hours** | | | | | | | | |
| Virtualization: Introduction to vSphere and the Software - Defined Data Center - Creating Virtual Machines - VCenter Server - Configuring and Managing - Virtual Networks - Configuring and Managing Virtual Storage - Virtual Machine Management - Resource Management and Monitoring. | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **Virtual Machines** | | | **15 hours** | | | | | | | | |
| Virtual Machines: vSphere HA - vSphere Fault Tolerance - Protecting Data vSphere DRS - Network Scalability - vSphere Update Manager and Host Maintenance - Storage Scalability - Securing Virtual Machines. | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Datacenter** | | **15 hours** | | | | | | | | | |
| Datacenter: Data center overview -Components - Provisions - Need of Data Center - Data Center Architecture - Different Racks - Data center architecture for cloud computing - role of data center in cloud computing. | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **77 hours** | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | |
| 1 | George Coulouris, Jean Dollimore, Tim Kindberg, Gordan Blair, “Distributed Systems Concepts and Design”, 5thEdition, Pearson Education, 2012. | | | | | | | | | | | | | | | |
| 2 | Venkata Josyula , Malcolm Orr , Greg Page, “Cloud Computing: Automating the Virtualized Data Center”, 1st Edition, Cisco Press, 2011. | | | | | | | | | | | | | | | |
| 3 | Brian J.S. Chee, Curtis Franklin Jr., “Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center”, 1st Edition, CRC Press, 2010. | | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | | |
| 1 | Andrew S. Tanenbaum, Maarten Van Steen, “Distributed Systems: Principles and Paradigms”, 2nd edition, Createspace Independent Publishers, 2016. | | | | | | | | | | | | | | | |
| 2 | Matthew Portnoy, “Virtualization Essentials”, 2nd edition, Wiley Publication, 2016. | | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | Cloud Computing and Distributed Systems, <https://nptel.ac.in/courses/106/104/106104182/> | | | | | | | | | | | | | | |
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| Course Designed By: **Dr. T. Amudha** | | | | | | | | | | | | | | | | |

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

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| **Course code** | | **25CSEAE04** | **DATA ANALYSIS AND BUSINESS INTELLIGENCE** | | | **L** | | | **T** | | | **P** | **C** |
| **Core/Elective/Supportive** | | | Elective | | | **4** | | | **-** | | | **-** | **4** |
| **Pre-requisite** | | | **Nil** | | | **Syllabus Version** | | | | | **1.0** | | |
| **Course Objectives:** | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand OLAP operations and basic Statistical concepts. 2. To understand the important concepts of Business Intelligence. 3. To create data warehouse for any domain. 4. To understand the Analytic concepts, tools and analysis of data using the tools. | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | |
| 1 | Understand the concepts of Data Warehousing and Statistics | | | | | | | | | K2 | | | |
| 2 | Analyze the correlation between various parameters of a data set using suitable techniques through statistical study | | | | | | | | | K4 | | | |
| 3 | Design a Data Warehouse and Analyze using OLAP. | | | | | | | | | K4, K6 | | | |
| 4 | Apply Predictive and Prescriptive Analytics in Business | | | | | | | | | K3 | | | |
| 5 | Identify suitable technique for various stages of data analytics | | | | | | | | | K4 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | |
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| **Unit:1** | | **DATA WAREHOUSING** | | | | | | **12 hours** | | | | | |
| Introduction – Data warehouse architecture – Dimensional Modeling – Aggregate Function – Summarisability – Fact-Dimension Relationship – OLAP Operations – Lattice of Cuboids – OLAP Server – ROLAP – MOLAP – Data Mart – ETL – Data Cleaning – ELT vs ETL – Cloud Data Warehousing. | | | | | | | | | | | | | |
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| **Unit:2** | | **STATISTICS FOR DATA ANALYSIS** | | | | | **14 hours** | | | | | | |
| Measures of Central Tendency and Dispersion: Arithmetic Mean - Median and Quantiles – Mode – Geometric Mean –Harmonic Mean. Measures of Dispersion: Range and Interquartile Range – Absolute Deviation, Variance, Standard Deviation – Coefficient of Variation. Correlation: Correlation and Causation – Types of Correlation – Karl Pearson’s Coefficient Correlation – Rank Coefficient of Correlation. Regression: Correlation and Regression – Graphic Method, Algebraic Method – Regression Line – Regression Equation – Mathematical Equation. Chi Square Test: Test of Goodness of Fit – Test of Independence – Test of Homogeneity. | | | | | | | | | | | | | |
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| **Unit:3** | | **ANALYTICS: A COMPREHENSIVE STUDY** | | | **12 hours** | | | | | | | | |
| Business Analytics – Analytics – Software Analytics – Embedded Analytics – Learning Analytics – Predictive Analytics – Prescriptive Analytics – Social Media Analytics – Behavioral Analytics. Analyse and predict results based on historical patterns. | | | | | | | | | | | | | |
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| **Unit:4** | | **BUSINESS INTELLIGENCE** | | | **12 hours** | | | | | | | | |
| Business Intelligence – Mobile Business Intelligence – Real-Time Business Intelligence – Context Analysis – Business Performance Management – Business Process Discovery - Information System – organizational Intelligence – Data Visualization – Data Profiling – Data Cleansing – Process Mining – Competitive Intelligence | | | | | | | | | | | | | |
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| **Unit:5** | | **BUSINESS INTELLIGENCE TOOLS** | | **10 hours** | | | | | | | | | |
| BI Tools Overview – BI Tools (Any One Tool in Depth): Microsoft Power BI – IBM Cognos - Tableau – MicroStrategy – QlikView. | | | | | | | | | | | | | |
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| **Unit:6** | | **CONTEMPORARY ISSUES** | | **2 hours** | | | | | | | | | |
| Data Warehouse Design for Hospital - Design Business Intelligence Model and Conduct Analysis.**Expert lectures, online seminars – webinars** | | | | | | | | | | | | | |
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|  | | **Total Lecture hours** | | **62 hours** | | | | | | | | | |

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| **Text Book(s)** | |
| 1 | Arun K Pujari **“Data Mining Techniques”**, 3rd Edition, University Press, 2013. |
| 2 | R.S.N.Pillai, Bagavathi, **“Statistics Theory and Practice”**, 8th Edition, S.Chand Publishing, 2016. |
| 3 | Drew Bentley, **“Business Intelligence and Analytics”**, Library Press, 2017. |
| **Reference Books : EBooks** | |
| 1 | Jiaweu Gab, Micgekube Janver, Jian Pei, **“Data Mining Concepts”**,Third Edition, Morgan Kaufmann Publications, 2012. |
| 2 | Christian Heumann, Michael Schomaker, Shalabh **“Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R”**, Springer, 2016. |
| 3 | Olivia Parr Rud **“Business Intelligence Success Factors: Tools for Aligning Your Business in the Global Economy”**, John Wiley & Sons, Inc., 2009. |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |

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|  | **Course Title** | **Duration** | **Provider** |
| 1. | Data Mining | 12 Weeks | Swayam |
| 2. | Business Statistics | 10 Weeks | Swayam |
| 3. | Business Analytics For Management Decision | 12 Weeks | Swayam |
| **Web link** | |  |  |
| 1. https://www.tutorialspoint.com/power\_bi/index.htm | | | |
| 1. https://tekslate.com/cognos | | | |
| 1. <https://help.tableau.com/current/guides/get-started-tutorial/en-us/get-started-tutorial-home.htm> | | | |
| 1. https://www.guru99.com/microstrategy-tutorial.html | | | |
| 1. https://www.edureka.co/blog/qlikview-tutorial/ | | | |
| Course Designed by: **Mr. S.Palanisamy** | | | |

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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 | S |  | S |  |
| **CO2** | M |  |  | M | M |  |  |  | M |  |
| **CO3** | M | S |  |  |  |  |  |  | S | M |
| **CO4** | S |  | L | S | S | M |  |  | M |  |
| **CO5** | S | S | M | L |  |  | S |  | M |  |
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| **Course code** | | **25CSEAE05** | **BIG DATA FRAMEWORKS & TOOLS** | | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | Core | | | **2** | | | **-** | | **2** | **4** |
| **Pre-requisite** | | | **Nil** | | | **Syllabus Version** | | | | **2** | | |
| **Course Objectives:** | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand Data source evolution, data Characteristics and Big data processing models. 2. To understand and apply Data Analytics Techniques on Datasets for specific domain and applications. 3. To understand BigData Technologies Hadoop and NoSQL Databases and components of Hadoop and MapReduce. 4. To understand and compare the architectural and processing of MapReduce Programing languages Pig, Hive and SPARK | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | |
| 1 | Understand Data sources, generations, data formats, Data Evolution, Data from various domains | | | | | | | | | | K1, K2 | |
| 2 | Understand Big Data Characteristics, Frameworks, components and Limitation of traditional approaches and map Big Vs to Data Domains | | | | | | | | | | K3 | |
| 3 | Configure and setup MapReduce Processing architectures Ecosystem – Hadoop, Pig, Hive, and Spark | | | | | | | | | | K2 | |
| 4 | Critically analyze case studies for and suggest MapReduce Programming models based on domains and applications | | | | | | | | | | K2-K5 | |
| 5 | Analyze various domains of Data Characteristics, Platform, Programming Model and Design Data Analytic ecosystem, and data processing framework | | | | | | | | | | K4-K5 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | |
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| **Unit:1** | | **Big Data Landscape** | | | | | | **18-- hours** | | | | |
| Data Evolution: Data Development Time Line – ICT Advancement-a Perspective – Data Growth-a Perspective –Understanding data: Data Classification Classification of digital Data - Data Sources - Data Science vs Statistics – Mathematics - Programming Language - Database, - Machine Learning. Data Analytics Relation: Data Science, Analytics, Big Data Analytics - Big Data: Introduction To Big Data: - Evolution What is Big Data – Sources of Big Data - Characteristics of Big Data - 7V’s – Big data- Data Processing Models – Limitation of Conventional Data Processing Approaches – Big Data Myths - Data Discovery-Traditional Approach, Big Data Technology: Big Data Exploration - Data Augmentation – Operational Analysis- Security and Intelligence – | | | | | | | | | | | | |
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| **Unit:2** | | **Big Data Components** | | | | | **18-- hours** | | | | | |
| Hadoop: Basic Concepts-An Overview of Hadoop-The Hadoop Distributed File System-Anatomy of a Hadoop Cluster-Hadoop Ecosystem Components- Common Hadoop Shell commands - Anatomy of File Write and Read, NameNode, Secondary Name Node, and Data Node - Hadoop Storage [HDFS] - Map Reduce Architecture - Hadoop Configuration: Environment : Steps – Hadoop 1.0 Version Vs Hadoop 2.0 YARN – Setting up Hadoop Eco System – Oozie – FLUME- STORM – FLUME - Pig Configuration – Hive Configuration - SPARK Configuration – Integration – Hadoop with R – Hadoop with Python – NoSQL Database: Types – Applications | | | | | | | | | | | | |
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| **Unit:3** | | **Introduction to PIG** | | | **18-- hours** | | | | | | | |
| Pig Introduction: Overview of Pig - Pig Architecture - Pig Execution modes, Pig Grunt shell and Shell -commands. Pig Latin Basis: Data model, Data Types, Operator - Pig Latin Commands - Load & Store, Diagnostic Operators, Grouping, Cogroup, Joining, Filtering, Sorting, Splitting - Built-In Functions, User define functions- Pig Execution Modes – Batch Mode – Embedded Mode – Pig Execution in Batch Mode – Embedding Pig in Python – Use cases - Map Reduce programs with Pig – Pig Vs SQL | | | | | | | | | | | | |
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| **Unit:4** | | **Introduction to HIVE** | | | **18-- hours** | | | | | | | |
| Introduction -Hive Architecture – Hive Query Language – Database Creation - group by and other clauses - Sorting and Aggregation – Partitioning – Static –Dynamic –HIVE Table Types – Hcatalog - Index Creation – Storing HIVE Results – HIVE partition - Buckets – Working complex Data Types – User-defined functions – Introduction to Impala – Comparing HIVE with Impala. | | | | | | | | | | | | |
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| **Unit:5** | | **SPARK Query** | | **18—hours** | | | | | | | | |
| Introduction - SPARK Basics – RDD Transformations – Aggregate Data with RDD - SPARK Operations – SPARK RDD Persistence - Use case with SPARK – Writing – Deploying – SPARK Applications | | | | | | | | | | | | |
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| **Unit:6** | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| Addressing C**ontroversy Views of social media – Big Data Source – Data Science Technology -** Expert lectures, online seminars – webinars | | | | | | | | | | | | |
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|  | | **Total Lecture hours** | | **92 -hours** | | | | | | | | |

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| **Text Book(s)** | |
| 1 | V. Bhuvaneswari, T. Devi, “**Big Data Analytics: A Practitioner’s Approach**”, Sci-Tech Publications, 2016. |
| 2 | Seema Acharya, Subhashni Chellappan, “**Big Data Analytics**”, Wiley, 2015 |
| 3 | Tom White, “**Hadoop: The Definitive Guide**”, O'Reilly Media 4th Edition, 2015 |
| 4 | Hrishikesh Vijay Karambelkar, “Apache Hadoop 3 Quick Start Guide: Learn about BigData Processing and Analytics”, 1st Edition, 2018, ISBN: 978-1788999830 |
| 5 | Ofer Mendelevitch, Casey Stella, Douglas Eadline, “Practical Data Science with Hadoop and Spark: Designing and Building Effective Analytics at Scale (Addison-Wesley Data & Analytics)”, 1st Edition, ISBN: 978-0134024141, 2016. |
| **Reference Books : EBooks** | |
| 1 | Sridhar Alla**, “Big Data Analytics with Hadoop 3”,** First Edition, ISBN: 978-1-78862-884-6, 2018, [Packt] |
| 2 | Naresh Kumar, **“Modern Big Data Processing with Hadoop”,** ISBN: 9781787122765, 2018, [Packt] |
| 3 | Thilina Gunarathne, **“Hadoop MapReduce v2 Cookbook”**, Second Edition, ISBN: 978-1-78328-547-1, 2015, [Packt] |
| 4 | Vignesh Prajapati, **“Big Data Analytics with R and Hadoop”,** First Edition, ISBN: 978-1-78216-328-2, 2013, [Packt] |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | |

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|  | **Course Title** | **Duration** | **Provider** |
| 1. | Big Data Hadoop and Spark Developer – R Programming | 26 hours | Simplilearn |
| 2. | Intro to Hadoop and MapReduce | 4 Weeks | Udacity |
| 3. | Hadoop Platform and Application Framework | 5 Weeks | Coursera |
| 4. | Big Data Essentials: HDFS, MapReduce and Spark RDD | 6 Weeks | Coursera |
| 5. | Mining Massive Datasets | 7 Weeks | edX |
| **Web link** | |  |  |
| 1. http://hadooptutorial.info/mapreduce-programming-model/ 2. https://hadoop.apache.org/docs/r1.2.1/mapred\_tutorial.html 3. https://hadoop.apache.org/docs/current/hadoop-mapreduce-client/hadoop-mapreduce-client-core/MapReduceTutorial.html 4. https://www.edureka.co/blog/mapreduce-tutorial/ | | | |
| Course Designed by: Dr. V. Bhuvaneswari | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | |
| **Cos** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** | L | M | S | S | S | M | M | M | S | M |
| **CO3** | M | M | M | M | S | S | S | S | S | S |
| **CO3** | M | M | M | M | S | S | S | S | S | S |
| **CO4** | S | S | S | S | S | S | S | S | S | S |
| CO5 | S | S | S | M | S | S | S | S | S | S |
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\*S-Strong; M-Medium; L-Low

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| **Course code** | | | **25CSEAE06** | **MongoDB Database** | | | **L** | | | **T** | | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **Elective** | | | **2** | | | **-** | | | **2** | **4** |
| **Pre-requisite** | | | | **Nil** | | | **Syllabus Version** | | | | |  | | |
| **Course Objectives:** | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the concepts of DBMS, Data Model and Normal forms. . 2. To understand the concepts of concurrency control and Recovery. 3. To understand basics of SQL and NoSQL databases. 4. To understand and apply MongoDB (NoSQL) for Data Analysis using CURD and User Management. | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | |
| CO1 | | Understand the structure and model of the relational database system. | | | | | | | | | K2 | | | |
| CO2 | | Design multiple tables, and using group queries. | | | | | | | | | K3 | | | |
| CO3 | | Design a database based on a data model normalization to a specified level | | | | | | | | | K4 | | | |
| CO4 | | Mongo DB& Operators | | | | | | | | | K3 | | | |
| CO5 | | Design a secure database and analyze with security protocols | | | | | | | | | K4, k6 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | |
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| **Unit:1** | | | **Database Overview** | | | | | | **20 hours** | | | | | |
| Introduction - Database concepts, Basic components of DBMS, sources of data - data models – hierarchical – network – XML and Stores - Relational Database Design: Anomalies in a Database–Functional Dependency – Lossless Join and Dependency – Preserving Decomposition – Third Normal Form– BoyceCodd Normal Form – Multivalued Dependency – Fourth Normal Form – Join Dependency – Project Join Normal Form –Domain Key Normal Form - SQL: Data Definition – Data Manipulation – Integrity Constraints–Views–PL/SQL. | | | | | | | | | | | | | | |
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| **Unit:2** | | | **NoSQL** | | | | | **20 hours** | | | | | | |
| Indexing and Hashing – Query Processing – Transaction Processing – Concurrency Control and Recovery - Advanced Database Concepts and Emerging Applications: Distributed Databases – Object Oriented Databases - Object Relational Databases- Data mining and Data Warehousing – Big Data - Big Databases- SQL–NoSQL Tradeoffs–CAP Theorem–Eventual Consistency - NoSQL–database types – Document Oriented – Columnar – Graph – KeyValue Pair - NoSQL database, design for performance / quality parameters, documents and information retrieval . | | | | | | | | | | | | | | |
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| **Unit:3** | | | **MongoDB Introduction** | | | **18 hours** | | | | | | | | |
| MongoDB- Introduction - MongoDb – Need – MongoDBVs RDBMS – MongoDB- Driver Installation – Configuration – Import and Export – MongoDB Server Configuration - Data Extraction Fundamentals - Intro to Tabular Formats - Parsing CSV -Parsing XLS with XLRD-Parsing XML - Intro to JSON - Getting Data into MongoDB - MongoDB- CURD – Database Creation – Update – Read – Delete | | | | | | | | | | | | | | |
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| **Unit:4** | | | **MongoDB Operators** | | | **16 hours** | | | | | | | | |
| Using mongoimport -Operators like $gt, $lt, $exists, $regex -Querying Arrays and using $in and $all Operators -Changing entries: $update, $set, $unset - Data Analysis - Field Queries -Projection Queries- Limiting – Sorting - Aggregation - Examples of Aggregation Framework -The Aggregation Pipeline - Aggregation Operators: $match, $project, $unwind, $group | | | | | | | | | | | | | | |
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| **Unit:5** | | | **Advanced MongoDB** | | **16 hours** | | | | | | | | | |
| User Management – MongoDb Data Replication in Servers – Data Sharding – MongoDB Indexes – Create – Find – Drop – Backup – MongoDB – Relationships – Analyzing Queries – MongoDBObjectid – Advanced MongoDB:MapReduce – MongoDB - Text Processing - Regular Expression – Case Studies – Text processing of large datasets, Map Reduce using MongoDB | | | | | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Data Security – Performance – Data Safety – Resource Utility – High Availability  Expert lectures, online seminars – webinars | | | | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | **92 hours** | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | |
| 1 | Abraham Silberchatz, Henry K.Forth, Sudharshan, “Database system Concepts”, 6th edition, McGraw Hill, 2010. | | | | | | | | | | | | | |
| 2 | Prabu C.S.R, “Object - Oriented Database Systems: Approaches and Architectures” 3rd Edition, PHI, 2011. | | | | | | | | | | | | | |
| 3 | Kristina Chodorow , “MongoDB: The Definitive Guide”, 2nd Edition , O'Reilly Media, 2013. | | | | | | | | | | | | | |
| 4 | Guy Harrison, “Next Generation Databases: NoSQL, NewSQL, and Big Data” Apress, 2016. | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | |
| 1 | Shamkant B.Navathe, Ramez Elamsri " Fundamentals of Database Systems ", 7th Edition, Pearson Education Limited, 2017. | | | | | | | | | | | | | |
| 2 | David Hows , Peter Membrey , Eelco Plugge , Timm Hawkins , “The Definitive Guide to MongoDB”, 3rd Edition, Apress, 2015. | | | | | | | | | | | | | |
| 3 | Gaurav Vaish , “Getting Started with NoSQL ” Packt Publishing, 2013. | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | |
| 1 | Database Management System: https://swayam.gov.in/nd2\_cec19\_cs05/preview | | | | | | | | | | | | | |
| 2 | Database Management System: https://nptel.ac.in/courses/106/105/106105175 | | | | | | | | | | | | | |
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| Course Designed By:**Dr. S. Gavaskar** | | | | | | | | | | | | | | |

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| **Mapping with Programme Outcomes** | | | | | | | | | | | | | | | | | | | | | | | | |
| **COs** | | | | **PO1** | | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | | | | | | **PO10** | | | |
| **CO1** | | | | L | | | L |  | | L |  |  |  |  | M | | | | | |  | | | |
| **CO2** | | | | M | | | M | S | | M |  |  | S |  | S | | | | | |  | | | |
| **CO3** | | | | M | | | S | S | | M |  |  | S |  | S | | | | | | M | | | |
| **CO4** | | | | S | | | S | S | | M |  |  | S |  | S | | | | | |  | | | |
| **CO5** | | | | M | | | S | S | | S |  |  | S |  | S | | | | | | S | | | |
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| **Course code** | | | | | | **25CSEAE07** | | | | **Neo 4j Database** | | | | | | | | | **L** | | | | **T** | | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | | | | | Elective | | | | | | | | | **2** | | | | **-** | | **2** | | **4** |
| **Pre-requisite** | | | | | | | | | | Students should know about the graph databases and cypher query language | | | | | | | | | **Syllabus Version** | | | | |  | | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the concepts of graph databases from a relational developer’s 2. To enlighten the conceptual differences between relational and graph database structures and data models. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | Describe the concepts of graph databases with relational databases and its transactions | | | | | | | | | | | | | | | | | | | | | K1, K2 | | |
| 2 | | | | Demonstrate environment setup of Neo4J by suitable Cypher Query Languageand their various clause | | | | | | | | | | | | | | | | | | | | | K2, K3 | | |
| 3 | | | | Study the syntax and properties of Meet cypher and develop case study on different Applications using Neo4J and CQL commands | | | | | | | | | | | | | | | | | | | | | K2,K3, K4 | | |
| 4 | | | | Analyse to import data from CSV files to a Neo4j graph database and to learn Backing up the Database | | | | | | | | | | | | | | | | | | | | | K2,K3, K4 | | |
| 5 | | | | Build the Application with Neo4j and Develop exciting real-world applications with Neo4j | | | | | | | | | | | | | | | | | | | | | K5,K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | | | **Introduction to Graph Databases** | | | | | | | | | | | | | | **14 hours** | | | | | | |
| Introduction to Graph Databases: - Introduction - Database Transactions – Graph - Graph Theory - Origins - Graph Databases - Relational Databases – Relationships – NoSQL - Key Value – Column - Document-orientated - Neo4j: Overview - Data Model - Environment Setup - Building Blocks – Download – Install. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | | | **Neo4j Clauses** | | | | | | | | | | | | | **18 hours** | | | | | | | |
| Neo4j – CQL: Introduction - Creating Nodes - Creating a Relationship - Write Clauses - Merge Command - Set Clause - Delete Clause - Remove Clause - Foreach Clause - Read Clause - Match Clause - Optional Match Clause - Where Clause - Count Function - Return Clause - Order By Clause - Limit Clause - Skip Clause - With Clause - Unwind Clause. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | | | **Cypher Queries** | | | | | | | | | | | **18 hours** | | | | | | | | | |
| Meet Cypher : Basic Syntax – Nodes – Properties – Relationships - Querying Cypher – Browser - REST API - How to Build a Cypher Query - A Quick note on Comments – Return – Match - Create/Create Unique - Delete/Remove – Where - Order By – Indexes – Constraints – Limit- Skip – With – Unwind – Union – Using – Merge – Set. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | | | **Data Import and Export** | | | | | | | | | | | **20 hours** | | | | | | | | | |
| Importing and Exporting Data: Importing Data - Import from a CSV Using Cypher - Using a Custom Import Script - Exporting Data - Backing up the Database - Getting Data from the Neo4j Browser - Write Your Own Data Exporter. Querying Data in Neo4j with Cypher- Getting the Data, the Website Used - Querying the Data - Location-Based Queries - Closest Metro Station. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | | | **Building Neo4j Applications** | | | | | | | | | | **20 hours** | | | | | | | | | | |
| Building an Application with Neo4j - A Quick Note on Code Comments - Installing the Spatial Plugin - What the App is Being Built On - How the Data will be Structured - Place/BusStop – Timetable – Transport - Building the Application - Installing Composer - Setting Up Silex - Silex Service Providers - Using the Client – Routes – Commands - Create Indexes - Import Bus Stops - Import Timetables - Setting up the Website with Commands - Technology Used | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | | | **Contemporary Issues** | | | | | | | | | | **2 hours** | | | | | | | | | | |
| Expert lectures, YouTubes Videos, Animations, NPTEL, MOOC videos, online seminars – webinars for strengthening the subject matters. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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|  | | | | | | | **Total Lecture hours** | | | | | | | | | | **92 hours** | | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Chris Kemper, “Beginning Neo4j”, Apress, 2016 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | Ankur Goel, “Neo4j Cookbook” , Packt Publishing, 2015 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Shehzad Ahmed, “Learning Neo4j 3.x”, Packt Publishing, 2019 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | Chris Fauerbach, “Learning Neo4j Graphs and Cypher”, Packt Publishing, 2017 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | Gregory Jordan, “Practical Neo4j”, Apress, 2015 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | Lecture Notes: https://www.slideshare.net/neo4j0 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | PPT Slides: https://www.slideshare.net/maxdemarzi/neo4j-presentation | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | Tutorials/Animations: https://www.tutorialspoint.com/neo4j/index.htm | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | | YouTube Videos: https://www.youtube.com/watch?v=Go3P73-KV30 | | | | | | | | | | | | | | | | | | | | | | | | |
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| Course Designed By: Dr. V. Bhuvaneswari | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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

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

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| **Course code** | | | | **25CSEAE08** | | **SOFT COMPUTING** | | | **L** | | | **T** | | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | Elective | | | **4** | | | **0** | | **0** | | **4** |
| **Pre-requisite** | | | | | | Knowledge of algorithms,  Problem solving strategies | | | **Syllabus Version** | | | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| The main objectives of the course are   1. To understand and apply evolutionary concepts. 2. To design neural network models. 3. To use fuzzy logic. 4. To apply soft computing frameworks to problem solving. | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | |
| CO1 | | | Understand soft computing methodologies in the context of modern heuristic methods | | | | | | | | | | K1, K2 | | | |
| CO2 | | | Gain knowledge in matching soft computing techniques in solving various classes of problems | | | | | | | | | | K3 | | | |
| CO3 | | | Analyze machine learning principles | | | | | | | | | | K4 | | | |
| CO4 | | | Solve optimization problems using suitable algorithms | | | | | | | | | | K5 | | | |
| CO5 | | | Develop effective algorithms for real-world applications | | | | | | | | | | K6 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Introduction to Soft computing** | | | | | | **12 hours** | | | | | |
| Introduction to Soft computing - Evolution of Computing - Soft Computing Elements – From Conventional AI to Computational Intelligence - Machine Learning – Optimization and search techniques - Multi-Objective optimization problems - Principles of Multi-objective optimization – Pareto-optimality - Pareto Front and Non-dominated Solutions. | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Evolutionary computing** | | | | | **12 hours** | | | | | | |
| Introduction to evolutionary computing - Genetic Algorithms - Evolutionary Strategies – Representations – Recombination - Binary Strings - Real-Valued Vectors - Various Selection Strategies. Search Operators - Crossover and Mutation – Fitness function - Generational cycles – Stopping criteria and constraints - Advances in Genetic Algorithms | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Neural Networks** | | | **12 hours** | | | | | | | | |
| Evolution of neural networks- basic models – Fundamentals of Artificial neural networks - Architecture – Learning Paradigms – Taxonomy -Activation functions - Machine Learning Using neural network, Adaptive networks – Supervised Learning and unsupervised learning networks – Advances in neural networks. | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **Fuzzy Logic** | | | **12 hours** | | | | | | | | |
| Fuzzy logic - Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions -Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making - Adaptive Neuro-Fuzzy Inference Systems. | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Bio-inspired Algorithms** | | **12 hours** | | | | | | | | | |
| Biologically inspired optimization techniques - Ant Colony Optimization - Pheromone mediated search -Search space - Exploration and Exploitation, Particle swarm optimization - PSO strategies and variants - Neighborhood topologies – Applications of Soft Computing - Real world Optimization problems. | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **62 hours** | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | |
| 1 | David E Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning ", Pearson Education India, 2013. | | | | | | | | | | | | | | | |
| 2 | S. Rajasekaran, G. A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Evolutionary Algorithms: Synthesis & Applications”, Prentice-Hall of India Pvt. Ltd., II edition, 2017. | | | | | | | | | | | | | | | |
| 3 | S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, 3rd edition, Wiley India Pvt Ltd, 2018. | | | | | | | | | | | | | | | |
| 4 | Andries P. Engelbrecht, “Fundamentals of Computational Swarm Intelligence”, Wiley publications, 2005. | | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | | |
| 1 | Xin She Yang, “Nature-Inspired Computation and Swarm Intelligence - Algorithms, Theory and Applications”, 1st Edition, Academic Press, 2020. | | | | | | | | | | | | | | | |
| 2 | Marco Dorigo, Thomas Stutzle, “Ant Colony Optimization”, MIT Press, 2010. | | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | Introduction to Soft Computing, <https://nptel.ac.in/courses/106/105/106105173/> | | | | | | | | | | | | | | |
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| Course Designed By: **Dr. T. Amudha** | | | | | | | | | | | | | | | | |

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

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| **Course code** | | | | **25CSEAE09** | | **INTELLIGENT AGENTS** | | | **L** | | | **T** | | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | Elective | | | **4** | | | **0** | | **0** | | **4** |
| **Pre-requisite** | | | | | | Basic knowledge of Artificial Intelligence | | | **Syllabus Version** | | | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To gain insight about automation using Intelligent Agents 2. 2. To understand the learning behavior and functioning of Agents   3. To develop knowledge in the application domains of Agents | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | |
| CO1 | | | To understand the fundamental concepts in intelligent agents. | | | | | | | | | | K1 | | | |
| CO2 | | | To understand agent communications and interactions | | | | | | | | | | K2 | | | |
| CO3 | | | To analyze various agent negotiation strategies | | | | | | | | | | K4 | | | |
| CO4 | | | To understand how learning happens in multiagent systems | | | | | | | | | | K2 | | | |
| CO5 | | | To evaluate current trends and applications of intelligent agents | | | | | | | | | | K5 | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | |  | | | | | | **12 hours** | | | | | |
| Introduction to Intelligent Autonomous Agents- Motivations for agent-based computing - Abstract Architectures for Intelligent Agents - Key concepts and models of reasoning agents – deductive reasoning - symbolic reasoning - reactive reasoning - practical reasoning - Rational decision making and handling uncertainty | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | |  | | | | | **12 hours** | | | | | | |
| Agent Interactions – Communication and cooperation – Ontology fundamentals – Building blocks – Ontology Languages – Software tools for ontologies – Agent Communication Languages. Conceptual Foundations of Communication in Multiagent systems - Traditional Software Engineering Approaches - Traditional AI Approaches - Commitment-Based Multiagent Approaches - Engineering with Agent Communication | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | |  | | | **12 hours** | | | | | | | | |
| Cooperative Distributed Problem Solving - Task Sharing and Result Sharing - Coordination - Multiagent Planning and Synchronization - Negotiation and Bargaining - Aspects of Negotiation - Game-Theoretic Approaches for Single-Issue Negotiation - Game-Theoretic Approaches for Multi-Issue Negotiation - Heuristic Approaches for Multi-Issue Negotiation -Argumentation-Based Negotiation | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | |  | | | **12 hours** | | | | | | | | |
| Multiagent Learning - Introduction - Challenges in Multiagent Learning - Reinforcement Learning for Multiagent Systems - Evolutionary Game Theory as a Multiagent Learning paradigm - Swarm Intelligence as a Multiagent Learning Paradigm -Neuro-Evolution as a Multiagent Learning Paradigm - Case Study in Multiagent Learning | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | |  | | **12 hours** | | | | | | | | | |
| Agent Applications - Agents for Workflow and Business Process Management - Agents for Distributed Sensing - Agents for Information Retrieval and Management - Agents for Electronic Commerce - Agents for Human–Computer Interfaces - Agents for Virtual Environments - Agents for Social Simulation - Deploying agents within a simulated environment - Practical reasoning strategies for computational markets | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars - webinars | | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **62 hours** | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | |
| 1 | Michael Wooldridge: An Introduction to MultiAgent Systems (2nd ed.). Wiley, 2009 | | | | | | | | | | | | | | | |
| 2 | G. Weiss (ed.): Multi-Agent Systems - A Modern Approach to Distributed Artificial Intelligence (2nd ed.). MIT Press, 2013 | | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | | |
| 1 | M. Wooldridge: Reasoning about Rational Agents. MIT Press, 2000 | | | | | | | | | | | | | | | |
| 2 | Yoav Shoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, 2008. | | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | <https://nptel.ac.in/courses/106/105/106105077/> | | | | | | | | | | | | | | |
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| Course Designed By: **Dr. T. Amudha** | | | | | | | | | | | | | | | | |

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

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| **Course code** | **25CSEAE10** | **MACHINE LEARNING** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | Elective | **2** | **-** | | **2** | **4** |
| **Pre-requisite** | | **Basics on Statistics and Linear Algebra** | **Syllabus Version** | | **1.0** | | |
| **Course Objectives:**   1. To understand the concepts of Machine learning algorithms 2. To apply the machine learning algorithms for various applications. | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | |

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| CO1 | Understand the concepts of machine learning | K1 |
| CO2 | Understand the theoretical concepts of probabilistic and linear methods | K2 |
| CO3 | Distinguish Supervised, Unsupervised and semi supervised learning | K2 |
| CO4 | Understand and Apply the algorithms for a given specific problem in a specific tool using Supervised, Unsupervised and semi supervised algorithms | K4, K5 |
| CO5 | Design a Machine Learning models for Prediction for any specific domain applications | K6 |
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| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | |
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| **Unit:1** | | | | **Unsupervised Models** | | | | | **18-- hours** |
| Introduction : Machine Learning - Machine Learning Foundations –Overview – applications - Types of machine learning - basic concepts in machine learning Examples of Machine Learning -Applications - - Unsupervised Learning Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model selection for latent variable models - high-dimensional spaces -- The Curse of Dimensionality -Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA- Independent components analysis | | | | | | | | | |
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| **Unit:2** | | | | **Linear Models** | | | | **18- hours** | |
| Supervised Learning Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison Linear Models for Classification - Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression. Decision Trees - Classification Trees- Regression Trees - Pruning. Support Vector Machines - Ensemble methods- Bagging- Boosting – Evaluation Methods | | | | | | | | | |
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| **Unit:3** | | | | **Graphical Models** | | | | **18- hours** | |
| Probabilistic Graphical Models Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties - From Distributions to Graphs -Examples -Markov Random Fields - Inference in Graphical Models - Learning –Naive Bayes classifiers-Markov Models – Hidden Markov Models – decoding states from observations, learning HMM parameters-Inference – Learning Generalization – Undirected graphical models- Markov random fields- Conditional independence properties - Parameterization of MRFs - Examples - Learning - Conditional random fields (CRFs) - Structural SVMs | | | | | | | | | |
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| **Unit:4** | | | | **Advanced Models** | | | | **18-- hours** | |
| Advanced Learning Sampling – Basic sampling methods – Monte Carlo. Reinforcement Learning- K-Armed Bandit Elements - Model-Based Learning- Value Iteration- Policy Iteration. Temporal Difference Learning Exploration Strategies- Deterministic and Non-deterministic Rewards and Actions- Eligibility Traces - Generalization- Partially Observable States- The Setting- Example. Semi - Supervised Learning. Computational Learning Theory - Mistake bound analysis, sample complexity analysis, | | | | | | | | | |
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| **Unit:5** | | | | **Deep Learning Models** | | | | **18-- hours** | |
| Neural Networks -Feed-forward Network Functions - Error Back propagation - Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods - Dual Representations - Radial Basis Function Networks – Sequence Models = Recurrent Net – Types – Word Disambiguation – Convolution Net – Basics – Applications | | | | | | | | | |
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| **Unit:6** | | | | **Contemporary Issues** | | | | **2 hours** | |
| Ethical Considerations in Machine Learning Applications – Ethics and Challenges of AI and ML as disruptive technology Use cases – Webinars | | | | | | | | | |
|  | | | | **Total Lecture hours** | | **92-- hours** | | | |
| **Text Books:** | | | | | | | | | | |
| **1** | | | Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2006 | | | | | | | |
| 2 | | | Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012 | | | | | | | |
| 3 | | | Ethem Alpaydin, “Introduction to Machine Learning 3(Adaptive Computation and Machine  Learning Series)”, Third Edition, MIT Press, 2014 | | | | | | | |
| 4 | | | Tom M Mitchell, “Machine Learning”, First Edition, McGraw Hill Education, 2013. | | | | | | | |
| **Reference Books** | | | | | | | | | | |
| 1 | | | Jannes Klaas, “Machine Learning for Finance”, ISBN: 978178936364, 2019 [Packt] | | | | | | | |
| 2 | | | Giuseppe Bonaccorso, “Machine Learning Algorithms”, Second Edition, ISBN:  9781789347999, 2018 [Packt] | | | | | | | |
| 3 | | | Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009 | | | | | | | |
| 4 | | | Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning”, Second Edition, Springer, 2008 | | | | | | | |
| 5 | | | Yuxi Liu, “Python Machine Learning By Example”, 2017 [Packt] | | | | | | | |
| 6 | | | [**John Paul Mueller**](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=John+Paul+Mueller&search-alias=stripbooks), [**Luca Massaron**](https://www.amazon.in/Luca-Massaron/e/B00RW7GV02/ref=dp_byline_cont_book_2), “Machine Learning (in Python and R) For Dummies”, First Edition, Wiley Publisher, ISBN: 9788126563050, 2016 | | | | | | | |
| 7 | | | [**U Dinesh Kumar Manaranjan Pradhan**](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=U+Dinesh+Kumar+Manaranjan+Pradhan&search-alias=stripbooks),, “Machine Learning using Python”. ) Publisher: Wiley, ISBN: 9788126579907, 2019 | | | | | | | |
| **Online Course:** | | | |  | |  | | | |
| **S. No** | | **Course Title** | | **Duration** | | **Provider -Free** | | | |
| 1. | | Machine Learning | | 12 hours | | Simlilearn | | | |
| 2. | | Machine Learning for Data Analysis | | 4 Weeks | | Coursera | | | |
| 3. | | Machine Learning Foundations: A Case Study Approach | | 6 Weeks | | Coursera | | | |
| 4. | | Machine Learning : Regression | | 6 Weeks | | Coursera | | | |
| 5. | | Introduction to Machine Learning | | 12 Weeks | | Swayam - NPTEL | | | |
| 6 | | Deep Learning Specialization | | 4 Courses | | Coursera | | | |

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| **Web Link - Video:**   1. 1. https://www.packtpub.com/data/hands-on-machine-learning-with-scikit-learn-and-tensorflow-2-0-video 2. 2. https://www.packtpub.com/data/machine-learning-projects-with-tensorflow-2-0-video 3. 3.https://www.packtpub.com/application-development/complete-machine-learning-course-python-video |

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

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

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| **Course code** | **25CSEAE11** | **EMBEDDED SYSTEMS** | **L** | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | **Elective** | **4** | **-** | | **0** | **4** |
| **Pre-requisite** | | **Applied Mathematics for Embedded Systems** | **Syllabus Version** | | **1.0** | | |
| **Course Objectives:**   1. to enable the students to understand embedded-system programming 2. to design and develop embedded solutions | | | | | | | |
| **Expected Course Outcomes:** | | | | | | | |

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| CO1 | Understand the concept of embedded systems, different components of embedded systems and firmware | K1 |
| CO2 | Understand the design and development of embedded systems, embedded operating systems and various embedded systems | K2 |
| CO3 | Learn embedded programming using JAVA to design embedded systems | K2 |
| CO4 | Learn and apply embedded programming using C to design embedded systems | K4, K5 |
| CO5 | Learn embedded programming using Arduino and V to design embedded systems | K6 |

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| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | |
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| **Unit:1** | | **Introductions to Embedded Systems** | | | **12-- hours** | |
| Basics of embedded systems - History of ES - Examples - Applications - Classifications - Components of a embedded systems - Hardware - Software – Digital electronics and circuits - Embedded systems : Real time – Online – Offline. Embedded Operating Systems – Firmware - emulator. | | | | | | |
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| **Unit:2** | | **Embedded system design** | | **12- hours** | | |
| Levels of Design abstraction: Requirements – Specification – Architecture – Component Design – System Integration. Design and Development of ES Life cycle model - Embedded system model : Application layer – System Software layer – Hardware layer. ISA models – Device drivers – ES Operating Systems: Process Management – Memory Management – I/O System Management. Comparison and Example: Microprocessor and Microcontroller – CISC and RISC. ES examples 8051 – PIC – AVR – ARM - Arduino. | | | | | | |
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| **Unit:3** | | **Open source Embedded Programming using JAVA** | | **12- hours** | | |
| EMBEDDED JAVA Introduction to Embedded Java and J2ME - Smart Card basics - Java card technology overview - Java card objects - Java card applets - working with APDUs - Web Technology for Embedded Systems. | | | | | | |
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| **Unit:4** | | **Open source Embedded Programming using C** | | **12-- hours** | | |
| C and assembly - Programming - Programming Style - Declarations and Expressions - Arrays Qualifiers and Reading Numbers - Decision and Control Statements - Programming Process - More Control Statements - Variable Scope and Functions - C Preprocessor - Advanced Types - Simple Pointers - Debugging and Optimization In line Assembly. Stages of Compilation - Introduction to GCC - Debugging with GDB - The Make utility - GNU Configure and Build System - GNU Binary utilities - Profiling using gprof - Memory Leak Detection with valgrind - Introduction to GNU C Library - Examples. Meeting Realtime constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts | | | | | | |
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| **Unit:5** | | **Case Study : Open source Embedded Programming using Arduino and C** | | **12-- hours** | | |
| Installation and configuring Arduino Studio – Introduction to Arduino products – Examples programs – sensors and actuators – Case Studies 4 Levels: Level 1 - Motion Following Camera Base - Lightning Detector for Arduino - Electronic Piano Keyboard with Preset Songs - Intelligent bug zapper – Photovore - Food Detector. Level 2 : control room temperature with an Arduino - Electronic nose with Taguchi gas sensors - Talking Clock - Balance multirotor motor using arduino & accelerometer - Arduino Ipod like-SMARTGPU2 - Email notifier - Make a speedometer for your vehicle using a hall effect sensor and a magnet - LED Matrix Control. Level 3 : theremin - Arduino Radio -Whole house climate control - UPS/power control system - Bluetooth Controlled Car over Android - Wifi controlled RC-Car - LED Clock . | | | | | | |
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| **Unit:6** | | **Contemporary Issues** | | **2 hours** | | |
| Expert lectures, online seminars - Webinars | | | | | | |
|  | | **Total Lecture hours** | **62-- hours** | | | |
| **Text Books:** | | | | | | | |
| **1** | | Embedded Systems – Raj Kamal, TMH, 2017 | | | | | |
| 2 | | Embedded System Design – Frank Vahid, Tony Givargis, John Wile, 2006 | | | | | |
| 3 | | Michael J Pont, “Embedded C”, Pearson Education, 2007 | | | | | |
| 4 | | Zhiqun Chen, „Java Card Technology for Smart Cards: Architecture and Programmer‟s Guide‟, Addison-Wesley Professional, 2000 | | | | | |
| 5 | | C Programming with Arduino - Julien Bayle – Packt Publishing Limited – 2013 | | | | | |
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| **Reference Books** | | | | | | | |
| 1 | | Simon Monk, “Make: Action, Movement, Light and Sound with Arduino and Raspberry Pi”, O’Reilly Series ,SPD,2016. | | | | | |
| 2 | | Tammy Noergaard, ”Embedded System Architecture, A comprehensive Guide for Engineers and Programmers”, Elsevier, 2006 | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | |
| * + - 1. <https://nptel.ac.in/courses/108102045> | | | | | | |
| * + - 1. <http://playground.arduino.cc/Projects/Ideas#Easy> | | | | | | |
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| Course Designed By: Mr Kathiresan, Dr T Devi | | | | | |

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

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

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| **Course code** | | | **25CSEAE12** | **SEMANTIC WEB** | | **L** | | | **T** | **P** | **C** |
| **Core/Elective/Supportive** | | | | **Elective** | | **4** | | | **0** | **0** | **4** |
| **Pre-requisite** | | | | **Nil** | | **Syllabus Version** | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are to:  1. To understand web 2.0 and web 3.0, the basics of semantic web, features, web standards.  2. To understand and apply knowledge representation methods, standard namespaces,  Graph based validation.  3. To analyze and Build Data Integration semantic layer use cases for specific domain and  applications. | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | | Understand Web standards, features, Distributed web data, limits of the web, Need of languages | | | | | | | | K1, K2 | |
| 2 | | Understand the concept of Ontology, Knowledge representation, scheme classification | | | | | | | | K6 | |
| 3 | | Understand the platform to model, semantic web tools: Triple stores, Development environments, Inference engines | | | | | | | | K4 | |
| 4 | | Understand the Semantic web layer for integration, Issues addressed, Representation formats, Mining stack and knowledge graphs. | | | | | | | | K2-K4 | |
| 5 | | Analyze various domains, Platform, Mapping of knowledge models, and semantic processing framework of domains of Transportation. | | | | | | | | K4-K5 K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | |
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| **Unit:1** | | | **Introduction to Semantic Web** | | | | | **12-- hours** | | | |
| Web 2.0 and 3.0 – Meaning of Semantic Data – Distributed web of data – Metadata - Features of semantic web – Data across the web – The basics of semantic web - The Limits of the web – The vision of the semantic web – Semantic web standards – RDF – RDF Scheme (RDFS) – OWL Web Ontology Language – SPARQL Protocol – RDF Query Language (SPARQL) - Need of RDFS – Machine Readability – core elements of RDFS – XML Schema – RDF schema | | | | | | | | | | | |
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| **Unit:2** | | | **Knowledge Representation Methods** | | | | **12-- hours** | | | | |
| The concept of Ontology - SKOS – Representation of thesauri - Glossaries – Scheme classification – Taxonomies – Controlled Vocabularies - Hierarchical Structure – Formal Representations - Standard Namespaces – JSON based serialization for Linked Data - RDF Triple stores – Turtle – RDFa – Internal Identifiers - URI – RDFS – Classes – Resources – Inferred Property Characterization – Literals – Linked Open Data – DBpedia – Querying RDF Graphs – Vocabularies – Graph based validation - Shape constraint Language (SHACL) | | | | | | | | | | | |
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| **Unit:3** | | | **Tools** | | **12-- hours** | | | | | | |
| **Triple store:** Jena – Allegro Graph – Mulgara – Sesame – Flickurl - Top Braid – Suite – Virtuoso Environment – Content Management System: Falcon – Drupal 7 – Redland – Pellet, **Development Environment:** Protégé – Ontotext – Open Anzo – RDF Gateway – RDFLib – DartGrid – Zitgist, **Inference Engines:** SWI-Prolog, Semantic Works –Ontobroker | | | | | | | | | | | |
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| **Unit:4** | | | **Data Integration Semantic Layer** | | **12-- hours** | | | | | | |
| Data Integration issues- Data Interoperability – Data Migration – Data Representation Formats – Data Silos – Linked Data Management – Knowledge Mining Stack – NLP – Named Entity Recognition – Machine Learning – Knowledge Graphs | | | | | | | | | | | |
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| **Unit:5** | | | **Use cases** | | **12-- hours** | | | | | | |
| Use cases Specifications and Discussion: - Transportation: Data Sources – Representation – Linked Data Mapping - Knowledge Modeling – Telecommunication – Knowledge Modeling – Customer Care Support Documents – Internal Reports – Named Entity Recognition – Linked Data Mapping | | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | **2-- hours** | | | | | | |
| **Customer provider mismatch – Interlinking domain specific information – Combining different services from different providers – contrast with contemporary web applications**Markup languages – Object Access Protocols – Service description – Discovery – Integration | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | **62-- hours** | | | | | | |
| **Text Book(s)** | | | | | | | | | | | |
| 1 | Dean Allemang, James Hendler: “Semantic Web for the Working Ontologist Effective Modeling in RDFs and OWL”, 2nd Edition, 2008. | | | | | | | | | | |
| 2 | Liyang Yu, “Introduction to the Semantic Web and Semantic web services” Chapman & Hall/CRC, Taylor & Francis group, 2007. | | | | | | | | | | |
| 3 | Toby Segaran, Colin Evans, Jamie Taylor, “Programming the Semantic Web”, 1st Edition, July 2009. | | | | | | | | | | |
| 4 | Pollock, J.T.: Semantic web for dummies. Wiley Publishing, Inc., Indianapolis, 2009. | | | | | | | | | | |
| **Reference Books : EBooks** | | | | | | | | | | | |
| 1 | Grigoris Antoniou and Frank van Harmelen, A Semantic Web Primer, The MIT Press (2004), ISBN: 0262012103 | | | | | | | | | | |
| 2 | P*.*Hitzler*,*R*.*Sebastian*,*M*.*Krötzsch*:*Foundation*of.*Semantic Web Technologies*,*2009*.* | | | | | | | | | | |
| 3 | Kalfoglou, Yannis, Cases on Semantic Interoperability for Information Systems Integration - Practices and Applications. IGI Global 2009, ISBN 978-1-60566-894-9 | | | | | | | | | | |
| 4 | [Martin Große-Rhode](https://www.bookdepository.com/author/Martin-Gro%C3%9Fe-Rhode), Semantic Integration of Heterogeneous Software Specifications, [Springer-Verlag Berlin and Heidelberg GmbH & Co. KG](https://www.bookdepository.com/publishers/Springer-Verlag-Berlin-and-Heidelberg-GmbH-Co-KG), 2010, ISBN 978-3-64207-306-9 | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | |
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|  | **Course Title** | **Duration** | **Provider** |
| 1. | Semantic Web Technologies (Free) | 6 Weeks | OpenHPI |
| 2. | Linked Data Engineering (Free) | 6 Weeks | OpenHPI |
| 3. | Introduction to a Web of Linked Data | 4 Weeks | Fun Inria |
| 4. | Web of Data | 17 hours | Coursera |
| 5. | Dynamics of Knowledge Organization (Free) | 2 hours | Udemy |
| **Web link** | |  |  |
| 1. <http://www.linkeddatatools.com/semantic-web-basics>  2. <http://www>.cambridgesemantics.com/blog/semantic-university/intro-semantic-web  3. https://www.mkbergman.com  4. <http://euclid-project.eu> | | | |
| Course Designed by: Dr.V.Bhuvaneswari | | | |

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

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

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| **Course code** | | | **25CSEAE13** | **SERVICE ORIENTED ARCHITECTURE AND WEB SERVICES** | | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | **Elective** | | | **4** | | | **-** | | **0** | **4** |
| **Pre-requisite** | | | | **Nil** | | | **Syllabus Version** | | | |  | | |
| **Course Objectives:** | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To familiar with the web services technology elements for realizing SOA | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | |
| CO1 | | To build applications based on XML. | | | | | | | | | | K2 | |
| CO2 | | To develop Web services using technology elements | | | | | | | | | | K2 | |
| CO3 | | Build SOA based applications for intra enterprise and inter enterprise applications | | | | | | | | | | K3 | |
| CO4 | | To identify and repair coding errors in a program | | | | | | | | | | K3 | |
| CO5 | | To develop web services with SOA architecture | | | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | |
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| **Unit:1** | | | **INTRODUCTION TO XML 9** | | | | | | **12 hours** | | | | |
| XML document structure – Well-formed and valid documents – Namespaces – DTD – XML Schema – X-Files | | | | | | | | | | | | | |
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| **Unit:2** | | | **BUILDING XML- BASED APPLICATIONS 9** | | | | | **12 hours** | | | | | |
| Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML. | | | | | | | | | | | | | |
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| **Unit:3** | | | **SERVICE ORIENTED ARCHITECTURE 9** | | | **13 hours** | | | | | | | |
| Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA — Principles of Service orientation – Service layers. | | | | | | | | | | | | | |
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| **Unit:4** | | | **WEB SERVICES 9** | | | **10 hours** | | | | | | | |
| Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions. | | | | | | | | | | | | | |
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| **Unit:5** | | | **BUILDING SOA-BASED APPLICATIONS 9** | | **13 hours** | | | | | | | | |
| Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines — Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EEframeworks: Django. | | | | | | | | | | | | | |
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| **Unit:6** | | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| Implement and use a web services based SOA technologies as well as tools- Usage of Web services protocols  Expert lectures, online seminars – webinars | | | | | | | | | | | | | |
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|  | | | **Total Lecture hours** | | **62 hours** | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | |
| 1 | Ron Schmelzer et al. “XML and Web Services”, Pearson Education, 2002.. | | | | | | | | | | | | |
| 2 | Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005 | | | | | | | | | | | | |
| 3 | Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2015. | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | |
| 1 | Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect’s Guide”, Prentice Hall, 2004 | | | | | | | | | | | | |
| 2 | Frank P.Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002. | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | |
| 1 | <https://www.fibre2fashion.com/industry-article/3062/web-services-implementation-methodology-for-soa-application> | | | | | | | | | | | | |
| 2 | https://www.c-sharpcorner.com/uploadfile/raj1979/database-connectivity-using-webservice/ | | | | | | | | | | | | |
| 3 | https://www.talend.com/resources/service-oriented-architecture/ | | | | | | | | | | | | |
| 4 | <https://www.sciencedirect.com/topics/computer-science/service-oriented-architecture> | | | | | | | | | | | | |
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| Course Designed By:**Dr. S. Gavaskar** | | | | | | | | | | | | | |

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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 | S |  | M | S |
| **CO2** | M | M | M | M |  |  | M |  | L | M |
| **CO3** | S | S | S | S |  | M | S |  | M | S |
| **CO4** | M | M | L | M |  |  | S |  | M | M |
| **CO5** | M | M | M | M |  |  | M |  | L | M |

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| **Course code** | | **25CSEAE14** | **SOCIAL MEDIA MINING** | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | **Elective** | | **4** | | | **-** | | **-** | **4** |
| **Pre-requisite** | | | **Nil** | | **Syllabus Version** | | | | | **1.0** | |
| **Course Objectives:** | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand how accurately analyze voluminous complex data set in social media and other sources 2. To understand the models and algorithms to process large data sets 3. To understand social behavior and recommendation challenges and methodologies | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | |
| 1 | Understand the concepts of Graph Models, social communities | | | | | | | | K1, K2 | | |
| 2 | Understand the network models and measures to evaluate information | | | | | | | | K3 | | |
| 3 | Understand and apply algorithms to model data using graph and network structures and recommendations | | | | | | | | K2,K5 | | |
| 4 | Brief on algorithms on social data diffusion and apply for various domains | | | | | | | | K2,K3, K4 | | |
| 5 | Distinguish and Suggest the appropriate algorithms for domain specific applications for data modelling and information diffusion, Evaluate the algorithms for metrics | | | | | | | | K4,K5, K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | |
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| **Unit:1** | | **Social Media Mining** | | | | | **12-- hours** | | | | |
| Social Media Mining - Introduction – Atoms – Molecules – Interactions – Social Media mining Challenges - Graphs - Basics – Nodes – Edges – Degree of Distribution- Types –Directed – Undirected – Weighted - Graph Connectivity - Tress and Forests – Bipartite graphs – Complete Graphs – Sub graphs – Planar Graphs - Graph Representation - Graph Traversal Algorithms – Shortest path algorithms Dijkstra’s - Spanning tree algorithms – Prims - Bipartite matching - Ford-Fulkerson algorithm | | | | | | | | | | | |
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| **Unit:2** | | **Network Models** | | | | **12-- hours** | | | | | |
| Network Models – Measures – Node : Eigen Centrality – Page Rank – Group Measures – Between ness centrality - group degree centrality, centrality, and group - Closeness centrality - Node Linking Behavior - Transitivity and reciprocity - Linking Analysis - Cluster coefficient – Jaccard - Case Study : -Modeling small networks with real world model | | | | | | | | | | | |
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| **Unit:3** | | **Social Media Communities** | | **12-- hours** | | | | | | | |
| Social media Communities – Social Communities – Member based Detection – Node degree – Node Similarity – Node reachability - Group Based detection methods - balanced – robust - modular – dense - hierarchical - Spectral Clustering : Balanced Community algorithm Community Evolution - Evaluation. | | | | | | | | | | | |
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| **Unit:4** | | **Social Network** | | **12-- hours** | | | | | | | |
| Social Network – Information Diffusion – Types - herd behavior - information cascades diffusion of innovation – epidemics – Diffusion Models Case Study – Herd Behavior – Information Cascades Methods – Social Similarity – assortativity – Social Forces - Influence homophily – Confounding - Assortativity measures – Influence measures – Predictive Models | | | | | | | | | | | |
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| **Unit:5** | | **Recommender System** | | **12-- hours** | | | | | | | |
| Recommendation Vs Search – Recommendation Challenges – Recommender algorithms - Content-Based Methods- Collaborative Filtering – Memory Based – Model Based – Social Media Recommendation – User friendship – Recommendation Evaluation – Precision – Recall – Behavioral– User Behavior – User – Community behavior – User Entity behavior – Behavioral Analytics - Methodology | | | | | | | | | | | |
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| **Unit:6** | | **Contemporary Issues** | | **2 hours** | | | | | | | |
| **1. Social Media Plagiarism – Legal and Ethical issues – Social Media Marketing**  2. Lack of focus – Productivity – Relationship – Infidelity – Privacy – Fake Identities  3. Negative impact on Academics – Cyber-crime – Bullying | | | | | | | | | | | |
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|  | | **Total Lecture hours** | | **62-- hours** | | | | | | | |

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| **Text Book(s)** | |
| 1 | **Reza Zafarani , Mohhammad AliAbbasi – Social Media Mining: An Introduction – Published by Cambridge press, 2014 – (Free Ebook available** http://dmml.asu.edu/smm/chapter**)** |
| 2 | **Memon, N., Xu, J.J., Hicks, D.L., Chen, H. (Eds.), Data Mining for Social Network Data- Springer – Annals of Information Systems ,ISBN 978-1-4419-6287-4** |
| 3 | Lam Thuy Vo, 2019, “Mining Social Media: Finding Stories in Internet Data |
| **Reference Books : EBooks** | |
| 1 | Matthew A. Russel and Mikhail Klassen, 2018, “Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub |
| 2 | GungorPolatkan, AntonoisChalkiopoulos, P. Oscar Boykin et.al., 2018, “Social Media Mining and Analytics. |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | |
|  | **Course Title** | **Duration** | **Provider** |
| 1. | Social Media Data Analytics (Free) | 4 Weeks | Coursera |
| 2. | Introduction to Social Media Analytics | 4 Weeks | Coursera |
| 3. | Social Media Analytics: Using Data to Understand Public Conversations | 3 Weeks | Future Learn |
| 4. | Starting with social network analysis | 2 hours | Udemy |
| **Web link** | |  |  |
| 1. <https://learn.g2.com/social-media-data-mining> 2. <https://www.javatpoint.com/social-media-data-mining> 3. <https://www.igi-global.com/dictionary/applying-critical-theories-to-social-media-mining-and-analysis/50376> 4. <https://www.cambridge.org/core/books/social-media-mining/introduction/75F143896832B7B9339F2CE663C4815B> | | | |
| Course Designed by: Dr. V. Bhuvaneswari | | | |

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| **Course code** | | | | **25CSEAE15** | | **RESPONSIVE WEB APPLICATIONS** | | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | Elective | | | **2** | | | **0** | | **2** | **4** |
| **Pre-requisite** | | | | | | HTML, CSS and Object Oriented Programming using JavaScript | | | **Syllabus Version** | | | | **1.0** | | |
| **Course Objectives:** | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand fundamentals of responsive web applications and Angular 2. To develop Angular Applications using Bootstrap 3. To develop Angular Applications using Material Design | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | |
| 1 | | | To learn the basics of Angular, Bootstrap and Material Design | | | | | | | | | | | K2 | |
| 2 | | | To understand and use Bootstrap components | | | | | | | | | | | K3 | |
| 3 | | | To develop responsive web applications using Angular and Bootstrap | | | | | | | | | | | K6 | |
| 4 | | | To explore and use Material Design components | | | | | | | | | | | K3 | |
| 5 | | | To develop responsive web applications using Angular and Material Design | | | | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Introduction to Angular** | | | | | | **16 hours** | | | | |
| **TypeScript**: Built-in Types – Classes – Utilities – Working with Angular CLI – **Building Blocks of Angular**: Modules – Components – Templates – Metadata – Data Binding – Directives – Services – Dependency Injection | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Introduction to Bootstrap** | | | | | **20 hours** | | | | | |
| **Bootstrap Components**: Introduction to Sass – Layouts with Grids and Containers – using Images – using Cards – using Buttons – Navs – Navbars - Carousal | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Applications using Angular and Bootstrap** | | | **20 hours** | | | | | | | |
| **Angular and Bootstrap**: Creating the Template – Welcome Page Analysis – Application Structure – Navigation Component Template Expressions – Template Statements – Data Binding – Bootstrap Forms | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **Introduction to Material Design** | | | **18 hours** | | | | | | | |
| **Material Design Components**: Data Binding: Input Elements – Form Fields – Drop Downs – Date Picker Control – Slider – Navigation: Toolbar – Sidenav – Layout: Card – Tabs – Material Design List – Alerts and Dialogs | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Applications using Angular and Material Design** | | **16 hours** | | | | | | | | |
| **Angular and Material Design**: Interpolation – Property Binding – Class Binding – Style Binding – Event Binding – Reactive Forms: Capture Changes – Validation – Route Outlet – Route Parameters – HTTP Client | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | |
| 1 | Nathan Murray, Felipe Coury, Ari Lerner and Carlos Taborda, ‘ng-book: The Complete Guide to Angular’, Fullstack.io, 2018 | | | | | | | | | | | | | | |
| 2 | Sergey Akopkokhyants, Stephen Radford, ‘Web Development with Bootstrap 4 and Angular 2’, Packt Publishing, 2016. | | | | | | | | | | | | | | |
| 3 | Venkata Keerti Kotaru, ‘Angular for Material Design’, Apress, 2020. | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | |
| 1 | Rajesh Gunasundaram, ‘Learning Angular for .NET Developers’, Packt Publishing, 2017. | | | | | | | | | | | | | | |
| 2 | Sridhar Rao Chivukula and Aki Iskandar, ‘Web Development with Angular and Bootstrap’, Packt Publishing, 2019. | | | | | | | | | | | | | | |
| 3 | Kyle Mew, ‘Learning Material Design’, Packt Publishing, 2015. | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | |
| 1 | | Angular Fundamentals (<https://www.edx.org/course/angular-fundamentals>) | | | | | | | | | | | | | |
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| Course Designed By: **Dr. R. Rajeswari** | | | | | | | | | | | | | | | |

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

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| **Course code** | | | | **25CSEAE16** | | **PROGRESSIVE WEB APPLICATION DEVELOPMENT** | | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | | Elective | | | **2** | | | **0** | | **2** | **4** |
| **Pre-requisite** | | | | | | HTML, CSS and Object-Oriented Programming using JavaScript | | | **Syllabus Version** | | | | **1.0** | | |
| **Course Objectives:** | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the basics of progressive web applications 2. To understand the fundamentals of Angular and develop Angular applications 3. To create, build and deploy progressive web applications using Angular | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | |
| 1 | | | To learn the basics of Angular and Progressive Web Applications | | | | | | | | | | | K2 | |
| 2 | | | To understand and use Angular forms, dependency injection and routing | | | | | | | | | | | K3 | |
| 3 | | | To create build and deploy an Angular application using Angular CLI | | | | | | | | | | | K6 | |
| 4 | | | To explore Service Workers, Data Storage, App Manifest and Notifications in Progressive Web Applications | | | | | | | | | | | K3 | |
| 5 | | | To build and deploy responsive, fast and reliable Progressive Web Applications using Angular | | | | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Building Blocks of Angular** | | | | | | **18 hours** | | | | |
| **TypeScript**: Built-in Types – Classes – Utilities – Working with Angular CLI – **Building Blocks of Angular**: Modules – Components – Templates – Metadata – Data Binding – Directives – Services – Dependency Injection | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Data Architecture and Testing in Angular** | | | | | **20 hours** | | | | | |
| Forms in Angular – HTTP - Routing – **Data Architecture in Angular**: Overview – Observables and RxJS – Redux in Angular – **Testing**: Testing Tools – End-to-End and Unit Testing – Testing Services and HTTP – Resting Routing to Components – Testing Forms – Testing HTTP requests | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Service Workers in Progressive Web Apps (PWAs)** | | | **18 hours** | | | | | | | |
| **Introduction to Progressive Web Apps (PWA)** – Current and Future PWA Support – Why Angular – Installing Node and NPM – **Service Workers**: Understanding Service Worker – Service Worker Life Cycle – Service Worker Functional Events – Cache API – Cache Strategies – Runtime Cache in Angular Service Worker | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **App Manifest, Notifications and App Shell** | | | **18 hours** | | | | | | | |
| Background Sync API – **Data Storage**: IndexedDB and localForage **– App Manifest:** The Web App Manifest – Adding Web App Manifest to Home Screen **– Notifications:** Web Notifications – Push Notifications – **App Shell:** App Shell Model – Angular App Shell – Further Optimizations – Exploring HTTP/2 and Server Push | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Debugging PWAs and Modern Web APIs** | | **16 hours** | | | | | | | | |
| **Debugging**: NGSW Debug – Web App Manifest – Service Workers – Storage – Cache – **Measurement**: Audit – Analytics –**Safety Service Worker**: Fail-safe – Safety Worker – **Modern Web APIs**: Credential Management – Payment Request – Video and Audio Capturing – Geolocation | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | |
| 1 | Nathan Murray, Felipe Coury, Ari Lerner and Carlos Taborda, ‘ng-book: The Complete Guide to Angular’, Fullstack.io, 2018 | | | | | | | | | | | | | | |
| 2 | Majid Hajian, ‘Progressive Web Apps with Angular’, Apress, 2019. | | | | | | | | | | | | | | |
| 3 | Dennis Sheppard, ‘Beginning Progressive Web App Development’, Apress, 2017. | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | |
| 1 | Tal Ater, ‘Building Progressive Web Apps’, O’Reilly Media, 2017. | | | | | | | | | | | | | | |
| 2 | Chris Love, ‘Progressive Web Application Development By Example’, Packt Publishing Ltd, 2018. | | | | | | | | | | | | | | |
| 3 | John M. Wargo, ‘Learning Progressive Web Apps’, Addison Wesley, 2020. | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | |
| 1 | | Developing Dynamic Web Applications Using Angular (<https://www.edx.org/course/developing-dynamic-web-applications-using-angular>) | | | | | | | | | | | | | |
| Course Designed By: **Dr. R. Rajeswari** | | | | | | | | | | | | | | | |

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

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| **Course code** | | | | **25CSEAE17** | **OPEN SOURCE PROGRAMMING** | | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | Elective | | | **2** | | | **0** | | **2** | **4** |
| **Pre-requisite** | | | | | RDBMS, HTML | | | **Syllabus Version** | | | | **1.0** | | |
| **Course Objectives:** | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand the basics of open source software 2. To create dynamic web applications using PHP, MySQL 3. To create web applications based on PHP and AJAX | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | |
| 1 | | | To explain the significance of open source principles and practices | | | | | | | | | | K1 | |
| 2 | | | To learn the fundamentals of PHP | | | | | | | | | | K2 | |
| 3 | | | To develop object oriented based applications using PHP | | | | | | | | | | K3 | |
| 4 | | | To develop web applications using PHP, MySQL and AJAX | | | | | | | | | | K6 | |
| 5 | | | To host open source projects using Github | | | | | | | | | | K6 | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create | | | | | | | | | | | | | | |
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| **Unit:1** | | | | **Open Source & Free Software Licensing** | | | | | | **20 hours** | | | | |
| **Open Source Licensing**: Basic Principles of Copyright Law – Contract and Copyright – Open Source Software Licensing – Issues with Copyrights and Patents – Open Source Definition – MIT License – BSD License – Apache License – GNU General Public License – **Free and Open Source Software Development**: Models of Open Source and Free Software Development – Choosing an Open Source or Free Software License | | | | | | | | | | | | | | |
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| **Unit:2** | | | | **Basics of PHP Programming** | | | | | **14 hours** | | | | | |
| **Basics of PHP Programming**: Introduction – syntax and variables – controls and functions – passing information between pages – strings – numbers – arrays, array functions and advanced array functions | | | | | | | | | | | | | | |
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| **Unit:3** | | | | **Advanced Features and Techniques** | | | **16 hours** | | | | | | | |
| **Advanced PHP Programming**: Object-Oriented Programming with PHP– String and Regular Expression Functions – Filesystem and System Functions – Sessions, Cookies and HTTP – Exceptions and Error Handling | | | | | | | | | | | | | | |
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| **Unit:4** | | | | **PHP and MySQL** | | | **20 hours** | | | | | | | |
| **PHP and MySQL**: Why PHP and MySQL? – Server-Side Web Scripting – SQL Tutorial – MySQL Database Administration – PHP/MySQL Functions – Displaying Queries in Tables – Building Forms from Queries | | | | | | | | | | | | | | |
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| **Unit:5** | | | | **PHP & AJAX and Github Hosting Service** | | **20 hours** | | | | | | | | |
| **PHP and AJAX**: JavaScript and AJAX Client – JavaScript and DOM – XMLHttp Request Object – AJAX form validation – Uploading a file using AJAX – Displaying a table in AJAX – Building Pagination using PHP and AJAX  **Hosting Open Source Projects using Github**: Introduction – Viewing Github Graphs- Editing Files – Collaborating on Pull Requests – Creating a Repository – Configuring a Repository | | | | | | | | | | | | | | |
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| **Unit:6** | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
|  | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | |
| 1 | Andrew M. St. Laurent, ‘Understanding Open Source & Free Software Licensing’, O’Reilly Media, 2004. | | | | | | | | | | | | | |
| 2 | Tim Converse and Joyce Park, ‘PHP 5 and MySQL Bible’, Wiley Publishing, 2004. | | | | | | | | | | | | | |
| 3 | Bogdan Brinzarea-Lamandi, Cristian Darie and Audra Hendrix, ‘AJAX and PHP’, Packt Publishing, 2009. | | | | | | | | | | | | | |
| 4 | Peter Bell and Brent Beer, ‘Introducing Github: a Non-Technical Guide’, O’Reilly Media, 2014 | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | |
| 1 | Gordon Haff, ‘How Open Source Ate Software’, Apress, 2018. | | | | | | | | | | | | | |
| 2 | Rao M. N., ‘Fundamentals of Open Source Software’, PHI Learning Pvt Ltd, 2014. | | | | | | | | | | | | | |
| 3 | Robin Nixon, ‘Learning PHP, MySQL & JavaScript with jQuery, CSS & HTML5’, O’Reilly Media, 2015. | | | | | | | | | | | | | |
| 4 | Steven Holzner, ‘PHP: The Complete Reference’, McGraw Hill Education, 2017. | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | |
| 1 | | [www.spoken-tutorial.org](http://www.spoken-tutorial.org) | | | | | | | | | | | | |
| 2 | | PHP and MySQL (<https://swayam.gov.in/nd2_aic20_sp32/>) | | | | | | | | | | | | |
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| Course Designed By: **Dr. R. Rajeswari** | | | | | | | | | | | | | | |

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

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

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| **Course code** | | | | | | **25CSEAE18** | | | | **.NET PROGRAMMING** | | | | | | | | | **L** | | | | **T** | | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | | | | | Elective | | | | | | | | | **2** | | | | **0** | | **2** | | **4** |
| **Pre-requisite** | | | | | | | | | | RDBMS | | | | | | | | | **Syllabus Version** | | | | | **1.0** | | | |
| **Course Objectives:** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To understand various .NET framework components and object oriented programming concepts in .NET 2. To create .NET applications using files and ADO.NET 3. To apply LINQ in VB.NET and C# Programming | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | | To design applications using Object Oriented concepts in VB.NET and C# | | | | | | | | | | | | | | | | | | | | | K3 | | |
| 2 | | | | To describe Thread creation, Multi-threading and synchronization, File handling operations | | | | | | | | | | | | | | | | | | | | | K4 | | |
| 3 | | | | To create Database ADO .NET components/ Files in designing applications for specific problems | | | | | | | | | | | | | | | | | | | | | K3 | | |
| 4 | | | | To evaluate the usage of LINQ features and .NET remoting in application designing | | | | | | | | | | | | | | | | | | | | | K5 | | |
| 5 | | | | To design and Develop Applications for real time societal problems using .NET Framework | | | | | | | | | | | | | | | | | | | | | K6 | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | | | **Introduction to C# and VB.NET** | | | | | | | | | | | | | | **16 hours** | | | | | | |
| Software Development and VB.NET – The VB.NET Development Environment – Common Elements in Visual C# 2008 – Name spaces Modules and Namespaces – data Types – Assignments and Operators – Types: Structures–Enumerations –Bitwise Enumeration –Equivalence versus Identity Structures and Enumeration – Control Structures – Control Flow – Error Handling: Basics | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | | | **Arrays, Collections and Exceptions** | | | | | | | | | | | | | **18 hours** | | | | | | | |
| Arrays and Collections:– Array Elements –Multidimensional Arrays –Jagged Arrays – System. Array– System.Array Properties – params keyword – Array Conversion Collections: Array List Collection – Bit Array Collection – Hash table Collection- A standard exception model –Structured Exception Handling–System.Exception–Remote Exceptions–Unhandled Exceptions | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | | | **Object Oriented Programming and Threading** | | | | | | | | | | | **18 hours** | | | | | | | | | |
| **Object Oriented Programming**: Class Fundamentals – Fields, Methods, Properties, Contractors, Events, Shared Members – Inheritance: Basics, Overriding, Sealed and Virtual Classes – Interfaces – Delegates – Attributes – **Threading**: Fundamentals, Thread Synchronization – Components and Assemblies – Reflection | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | | | **File Handling and ADO.NET** | | | | | | | | | | | **18 hours** | | | | | | | | | |
| **Files and Directories**: Directory and File Classes, Path Class – Streams: Stream class, stream operations, stream readers and writers, reading and writing text files, reading and writing xml files – **Data Access with ADO.NET** – Binding controls to database- Handling Database in Code-XML and ADO.NET | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | | | **LINQ, Collections and Application Deployment** | | | | | | | | | | **20 hours** | | | | | | | | | | |
| **Introduction to LINQ**: C# Extension-LINQ Essentials–LINQ to Objects–Examples of LINQ to Object as–LINQ Operators. Queue Collection–Stack Collection– Specialized Collections – .NET Remoting - .Net Core – Introduction – Application Deployment Types – Docker – Basics – Containers – Creating Docker | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | | | **Contemporary Issues** | | | | | | | | | | **2 hours** | | | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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|  | | | | | | | **Total Lecture hours** | | | | | | | | | | **92 hours** | | | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Donis Marshall, “Programming Visual C# 2008: The Language “, Microsoft Press Publication, 2008. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | The Complete Reference – Visual Basic .NET, JefreyR.Shapiro, Tata McGraw-Hill, 2002 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Reference Books** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | Christian Nagel, Bill Evjen, Morgan Skinner, Jay Glynn, Karli Watson, ‘Professional C# 2012 and .NET 4.5’, Wiley India, 2012. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | StevemHolzner, ‘Visual Basic .Net Programming Black Book’, Dreamtech Press, Reprint 2011 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | Andrew Troelsen and Philip Japikse, ‘C# and the .NET 4.6 Framework’, Apress 2017. | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | | Mark J. Price, ‘C# 8.0 and .NET Core 3.0’, Packt Publishing, 2019 | | | | | | | | | | | | | | | | | | | | | | | | | |
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| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | | | www.spoken-tutorial.org | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | .net core Guide - https:/docs.microsoft.com | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | <https://www.tutorialsteacher.com/core/aspnet-core-middleware> | | | | | | | | | | | | | | | | | | | | | | | | |
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| Course Designed By: **Dr. R. Rajeswari** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Mapping with Programme Outcomes** | | | | | | | | | | | | | | | | | | | | | | | | |
| **COs** | | | | **PO1** | | | **PO2** | **PO3** | | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | | | | | | **PO10** | | | |
| **CO1** | | | |  | | | M | S | | S |  |  | M |  | L | | | | | |  | | | |
| **CO2** | | | |  | | | M | S | | S |  |  | M |  | L | | | | | |  | | | |
| **CO3** | | | |  | | | M | S | | S |  |  | M |  | L | | | | | |  | | | |
| **CO4** | | | |  | | | M | S | | S |  |  | M |  | L | | | | | |  | | | |
| **CO5** | | | |  | | |  | S | | S |  |  |  |  | S | | | | | | S | | | |

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

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| **Course code** | | | | **25CSEAE19** | **Graphical Programming and Virtual Instrumentation** | | | **L** | | | **T** | | **P** | **C** |
| **Core/Elective/Supportive** | | | | | Elective | | | **2** | | | **-** | | **2** | **4** |
| **Pre-requisite** | | | | | Students should know about the concept of graphical programming and virtual instrumentation | | | **Syllabus Version** | | | |  | | |
| **Course Objectives:** | | | | | | | | | | | | | | |
| The main objectives of this course are to:   1. To realize the concept of Graphical Programming and Virtual Instrumentation 2. Understanding Virtual Instrument concepts and Creating Virtual Instruments for practical works 3. to develop basic VI programs using loops, case structures etc. including its applications in Data Acquisition, Machine Vision, Image Processing and Analysis | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | |
| 1 | | | Describe the concepts of Graphical System Design Model using LabView and its applications | | | | | | | | | | K1 & K2 | |
| 2 | | | Demonstrate of LabVIEW software environment and creating saving a VI with keyboard shortcuts | | | | | | | | | | K2 & K3 | |
| 3 | | | Study the structure of modular programing and Build A Vi Front Panel and Block Diagramusing LabVIEW software | | | | | | | | | | K2, K3 & K4 | |
| 4 | | | Analyse the loops, arrays, clusters and error handling using LabVIEW concepts in real-time applications | | | | | | | | | | K2, K3 & K4 | |
| 5 | | | Construct the various analysis using Data Acquisition, Image Processing, Particle and Machine Vision with GSD Applications | | | | | | | | | | K5 & K6 | |
| **K1** - Remember; **K2** - Undestand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | |
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| **Unit:1** | | | | **Introduction to Graphical System Design** | | | | | | **16 hours** | | | | |
| Graphical System Design: Introduction, Graphical System Design Model, Design Flow With Gsd, Virtual Instrumentation, Virtual Instrument and Traditional Instrument, Hardware and Software In Virtual Instrumentation, Virtual Instrumentation For Test, Control And Design, Virtual Instrumentation In The Engineering Process, Virtual Instruments Beyond Personal Computer, Graphical System Design Using Labview, Graphical Programming and Textual Programming. | | | | | | | | | | | | | | |
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| **Unit:2** | | | | **Introduction to Labview** | | | | | **18 hours** | | | | | |
| Introduction, Advantages of Labview, Software Environment, Creating and Saving A Vi, Front Panel Toolbar, Block Diagram Toolbar, Palettes, Shortcut Menus, Property Dialog Boxes, Front Panel Controls and Indicators, Block Diagram, Data Types, Data Flow Program, Labview Documentation Resourses, Keyboard Shortcuts. | | | | | | | | | | | | | | |
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| **Unit:3** | | | | **Modular Programming** | | | **18 hours** | | | | | | | |
| Modular Programming – Introduction, Modular Programming In Labview, Build A Vi Front Panel and Block Diagram, Icon and Connector Pane, Creating an Icon, Building A Connector Pane, Displaying Subvis and Express Vis as Icons orExpandable Nodes, Creating Subvis From Sections of A Vi, Opening and Editing Subvis, Placing Subvis On Block Diagrams, Saving Subvis, Creating A Stand-Alone Application. | | | | | | | | | | | | | | |
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| **Unit:4** | | | | **Programming in Lab View** | | | **18 hours** | | | | | | | |
| Repetition and Loops - for loops - While Loops, Structure Tunnels. Arrays: Introduction - Arrays in LabVIEW – 1D, 3D and Multidimensional Arrays. Clusters: Introduction - Creating Cluster Controls And Indicators - Creating Cluster Constant - Order of Cluster Elements - Cluster Operations - Assembling Clusters - Disassembling Clusters - Conversion Between Arrays and Clusters - Error Handling - Error Cluster. | | | | | | | | | | | | | | |
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| **Unit:5** | | | | **Analysis using Lab View** | | **20 hours** | | | | | | | | |
| Structures – Introduction - Case Structures - Sequence Structures - Customizing Structures - Timed Structures - Event Structure. Strings and File i/o: Introduction - Creating String Controls And Indicators - String Functions. Data Acquisition - Image Processing and Analysis, Particle Analysis, Machine Vision, LabVIEW Tool and Gsd Applications. | | | | | | | | | | | | | | |
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| **Unit:6** | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | |
| Expert lectures, YouTubes Videos, Animations, NPTEL, MOOC videos, online seminars – webinars for strengthening the subject matters. | | | | | | | | | | | | | | |
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|  | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | |
| **Text Book(s)** | | | | | | | | | | | | | | |
| 1 | Jovitha Jerome, “Virtual InstrumentationUsing Labview”, PHI Learning Private Ltd., 2010 | | | | | | | | | | | | | |
| 2 | Gary W. Johnson and Richard Jennings, “LabVIEW Graphical Programming”, McGraw-Hill Inc., 2006 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | |
| 1 | Bruce Mihura, “LabVIEW for Data Acquisition”, Prentice Hall, 2001 | | | | | | | | | | | | | |
| 2 | Gupta, Virtual Instrumentation Using Lab view 2nd Edition, Tata McGraw-Hill Education, 2010 | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | |
| 1 | | Lecture Notes: <https://www.bharathuniv.ac.in/colleges1/downloads/courseware_ece/notes/BEI704%20%20%20-%20virtual%20instrumentation.pdf> | | | | | | | | | | | | |
| 2 | | PPT Slides: https://www.slideshare.net/PrincyRandhawa/virtual-instrumentation-labview | | | | | | | | | | | | |
| 3 | | Tutorials/Animations:https://www.ni.com/en-in/innovations/white-papers/06/virtual-instrumentation.html | | | | | | | | | | | | |
| 4 | | YouTube Videos: <https://www.youtube.com/watch?v=u-AzZV-Ooyk> | | | | | | | | | | | | |
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| Course Designed By : Dr. R. Rajeswari | | | | | | | | | | | | | | |

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

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

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| **Course code** | | | | **25CSEAE20** | | **COMPUTER GRAPHICS AND MULTIMEDIA** | | | **L** | | | | **T** | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | Elective | | | **2** | | | | **0** | **2** | | **4** |
| **Pre-requisite** | | | | | | None | | | **Syllabus Version** | | | | | | **2.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To understand the Computer Graphics and the various graphic algorithms. 2. To understand the 2D and 3D transformations, models and generation techniques 3. To understand the Multimedia animation and Desktop Computing. | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | |
| 1 | | | To understand the activities involved in modelling, rendering, shading and animation of computer graphics. | | | | | | | | | K1, K2 | | | | |
| 2 | | | To use OpenGL to create interactive computer graphics. | | | | | | | | | K3 | | | | |
| 3 | | | To understand a typical graphics pipeline and make pictures with their computer. | | | | | | | | | K4, K6 | | | | |
| 4 | | | To understand the latest interactive multimedia devices, and image formats. | | | | | | | | | K4, K5 | | | | |
| 5 | | | To understand data compression, image compression and video compression techniques and develop an interactive multimedia presentation. | | | | | | | | | K5, K6 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Introduction to Computer Graphics** | | | | | | **12 hours** | | | | | |
| A Survey of Computer Graphics – Overview of Graphics Systems: Video Display Devices – Input Devices – Graphics Software. | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Two dimensional graphics** | | | | | **20 hours** | | | | | | |
| Output Primitives: Points and Lines – Line Drawing Algorithms: DDA – Bresenham`s. Properties of Circles and Ellipses – Pixel Addressing. Two Dimensional Geometric Transformations: Basic Transformations – Matrix Representation – Composite Transformations. | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **Three dimensional graphics** | | | **20 hours** | | | | | | | | |
| Three-Dimensional Display Methods – Three Dimensional Geometric and Modeling Transformations: Translation – Rotation – Scaling – Composite Transformations - Color Models and Color Applications. | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **Introduction to Multimedia** | | | **18 hours** | | | | | | | | |
| Multimedia: Introduction, Definition, Uses of Multimedia, Delivering Multimedia, computer display Vs TV display - TEXT: Fonts and Faces - Using Text in Multimedia - Computers and Text - Font Editing and Design Tools - Hypermedia and Hypertext. – using MAYA / 3ds MAX / Dreamweaver | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Images, Audio and Video** | | **20 hours** | | | | | | | | | |
| Images: Making Still Images - Image File Formats - 2 D, 3 D - Sound: Digital Audio - MIDI Audio - MIDI vs. Digital Audio - Audio File Formats - Adding Sound to Your Multimedia Project - Animation – Video: Analog, Digital - Digital Video Containers - Obtaining Video Clips - Shooting and Editing Video – using MAYA / 3ds MAX / Dreamweaver – Design of UI / UX | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | | |
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| **Text Books** | | | | | | | | | | | | | | | | |
| 1. | Donald Hearn & M.Pauline Baker, “Computer Graphics”, Second Edition, PHI/ Pearson Education. | | | | | | | | | | | | | | | |
| 2. | H.M.Neumann and R.F.Sproul, “Principles of Interactive computer Graphics”, Second Edition, McGraw Hill. | | | | | | | | | | | | | | | |
| 3. | Multimedia Making It work – 9th Edition, Tay Vaughan, Mc Graw Hill, 2016 | | | | | | | | | | | | | | | |
| 4. | Autodesk Maya Press, “Learning Autodesk Maya 2016: Foundation”, John Wiley & Sons, 2015 | | | | | | | | | | | | | | | |
| 5. | Kelly L. Murdock, ‘3ds Max 2021: Complete Reference Guide’, SDC Publications, 2020. | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | |
| 1. Steven Harrington, “Computer Graphics – A Programming Approach”, McGraw Hill, 1983. | | | | | | | | | | | | | | | | |
| 2. John F. Hughes, Andries van Dam, Morgan McGuire, David F. Sklar, James D. Foley, Steven K. Feiner, Kurt Akeley, “Computer Graphics: Principles and Practice”, Addison-Wesley Professional; 3rd edition, 2013. | | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | Computer Graphics, <https://nptel.ac.in/courses/106/106/106106090/> | | | | | | | | | | | | | | |
| 2 | | Multimedia Systems, <https://nptel.ac.in/courses/117/105/117105083/> | | | | | | | | | | | | | | |
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| Course Designed By: **Dr. J. Satheesh Kumar** | | | | | | | | | | | | | | | | |

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

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| **Course code** | | | | **25CSEAE21** | | **AUGMENTED REALITY** | | | **L** | | | | **T** | **P** | | **C** |
| **Core/Elective/Supportive** | | | | | | Core | | | **2** | | | | **0** | **2** | | **4** |
| **Pre-requisite** | | | | | | None | | | **Syllabus Version** | | | | | | **2.0** | |
| **Course Objectives:** | | | | | | | | | | | | | | | | |
| The main objectives of this course are:   1. To understand the concepts behind AR 2. To design and develop AR applications | | | | | | | | | | | | | | | | |
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| **Expected Course Outcomes:** | | | | | | | | | | | | | | | | |
| On the successful completion of the course, student will be able to: | | | | | | | | | | | | | | | | |
| 1 | | | To understand Virtual and Augmented reality | | | | | | | | | K1, K2 | | | | |
| 2 | | | To understand the AR and VR development environment | | | | | | | | | K2, K3 | | | | |
| 3 | | | To do basic VR and AR development | | | | | | | | | K3, K6 | | | | |
| 4 | | | To create AR Environments | | | | | | | | | K6 | | | | |
| 5 | | | To design and develop AR applications | | | | | | | | | K5, K6 | | | | |
| **K1** - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create | | | | | | | | | | | | | | | | |
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| **Unit:1** | | | | | **Introduction to Augmented Reality** | | | | | | **16 hours** | | | | | |
| Introduction to Augmented Reality (AR), Virtual Reality (VR), eXtended Reality (XR) - Introduction to Unity3D and Content Generation Tools - History, evolution and market impact - Sample applications of AR, VR, XR: Presentation | | | | | | | | | | | | | | | | |
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| **Unit:2** | | | | | **Design Theory of AR** | | | | | **18 hours** | | | | | | |
| Design application: Theory - Story and process - Scripting principles - Hardware: AR, VR, XR - Hardware: Development environment - Tools, Software Development Kit (SDK), Scripting | | | | | | | | | | | | | | | | |
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| **Unit:3** | | | | | **AR Development** | | | **18 hours** | | | | | | | | |
| Basic development: Identifying basic design principles, reciting common choices, styles, and/or aesthetics Visual, audial, interactive, and narrative - System Dynamics and Scripting Fundamentals - Interfaces, Environments, Asset Management, and Animation - Project 1: Creating a project and environment - Project 2: Creating and using an asset - Project 3: Creating and using a Component – using MAYA | | | | | | | | | | | | | | | | |
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| **Unit:4** | | | | | **AR Environment** | | | **18 hours** | | | | | | | | |
| Creating Environment: Principles of Cameras and Lighting in Application Environments- Principles of Audio, Animation - Physics, Particle system - Interaction: Eye tap, Gaze, Handheld controllers – Tracking – Spatial immersion and interaction – Principles of Quality and Functionality Assurance in Development - using MAYA | | | | | | | | | | | | | | | | |
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| **Unit:5** | | | | | **Creating AR Applications** | | **20 hours** | | | | | | | | | |
| Project 4: Creating first application - Project 5: Creating a simple application: Principles of Versioning and Release – Packaging - Installing application on the device – Practical Applications: Virtual Circuit - Virtual Chemistry lab - Virtual Dental experiment – Game - Virtual Assembly and Repair - Augmented Book - Augmented Tourism - Augmented Healthcare: X-rays | | | | | | | | | | | | | | | | |
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| **Unit:6** | | | | | **Contemporary Issues** | | **2 hours** | | | | | | | | | |
| Expert lectures, online seminars – webinars | | | | | | | | | | | | | | | | |
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|  | | | | | **Total Lecture hours** | | **92 hours** | | | | | | | | | |
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| **Text Books** | | | | | | | | | | | | | | | | |
| 1 | Erin Pangilinan, Steve Lukas, et al. ‘Creating Augmented and Virtual Realities: Theory and Practice for Next-Generation Spatial Computing’, Apr 14, 2019 | | | | | | | | | | | | | | | |
| 2 | Steve Aukstakalnis, ‘Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR (Usability)’, 2016 | | | | | | | | | | | | | | | |
| 3 | Jonathan Linowes, ‘Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia’, October 9, 2017 | | | | | | | | | | | | | | | |
| **Reference Books** | | | | | | | | | | | | | | | | |
| 1. Michael Wohl, ‘The 360° Video Handbook: A step-by-step guide to creating video for virtual reality (VR)’, July 1, 2017 | | | | | | | | | | | | | | | | |
| 1. John Bucher, ‘Storytelling for Virtual Reality: Methods and Principles for Crafting Immersive Narratives’, Jul 6, 2017 | | | | | | | | | | | | | | | | |
| 1. Jonathan Linowes, ‘Unity Virtual Reality Projects: Learn Virtual Reality by developing more than 10 engaging projects with Unity 2018’, 2nd Edition 2nd Edition, Kindle Edition | | | | | | | | | | | | | | | | |
| **Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** | | | | | | | | | | | | | | | | |
| 1 | | Virtual Reality, <https://nptel.ac.in/courses/106/106/106106138/> | | | | | | | | | | | | | | |
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| Course Designed By: **Dr. J. Satheesh Kumar** | | | | | | | | | | | | | | | | |

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| **COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** |
| **CO1** |  | S | M | M | S | S | S |  | S | L |
| **CO2** |  | S | S |  |  |  |  |  |  |  |
| **CO3** |  | S |  | L |  |  |  |  |  |  |
| **CO4** |  | S | L | S | S | S | S | L | S | L |
| **CO5** |  | S | L | M | S | M |  |  | S | M |
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\*S-Strong; M-Medium; L-Low